

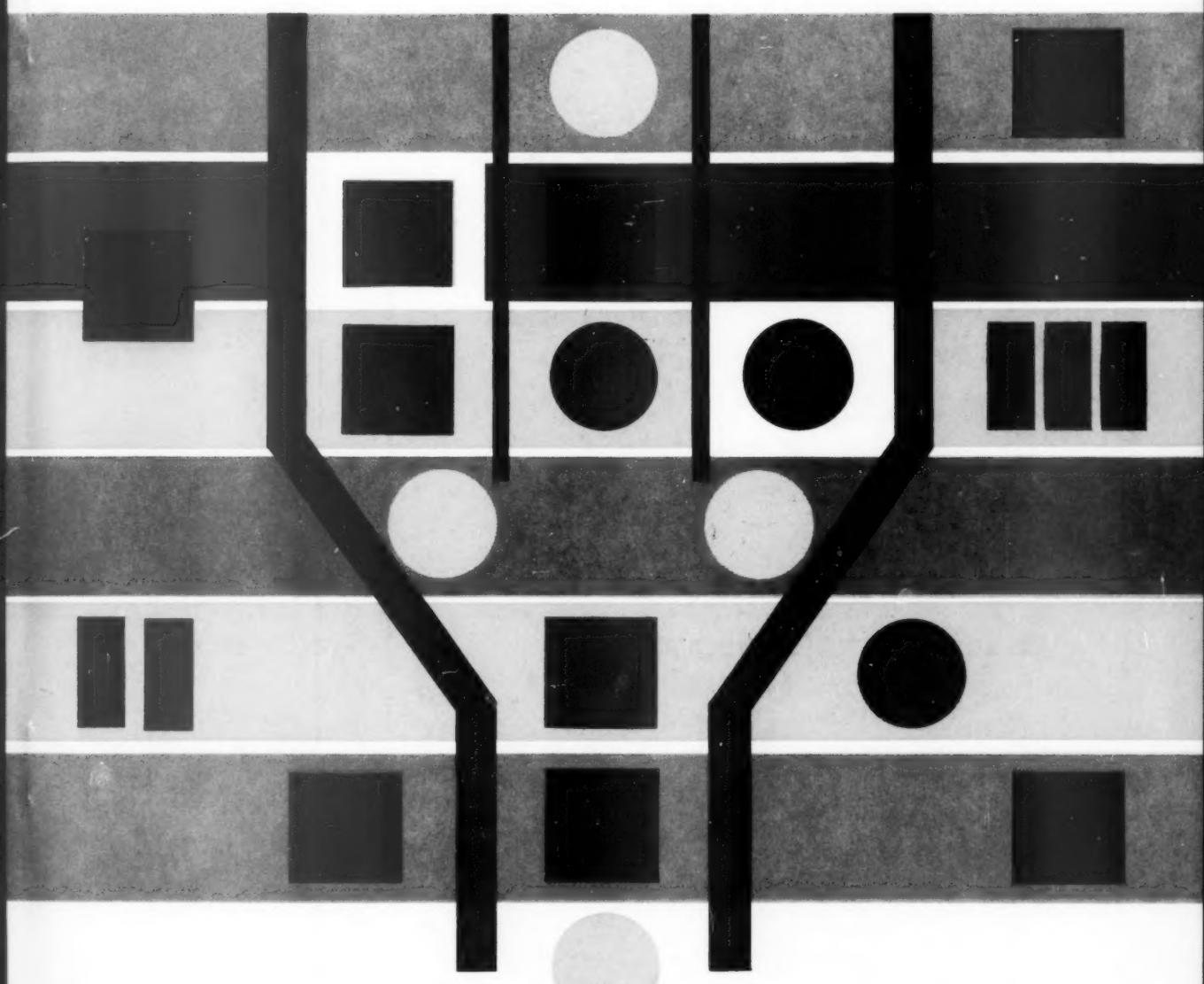
A HITCHCOCK PUBLICATION

assembly & fastener


ENGINEERING

NOVEMBER • 1961

50 CENTS



assembly control through automatic data processing



**this man
a
fastener
problem...**

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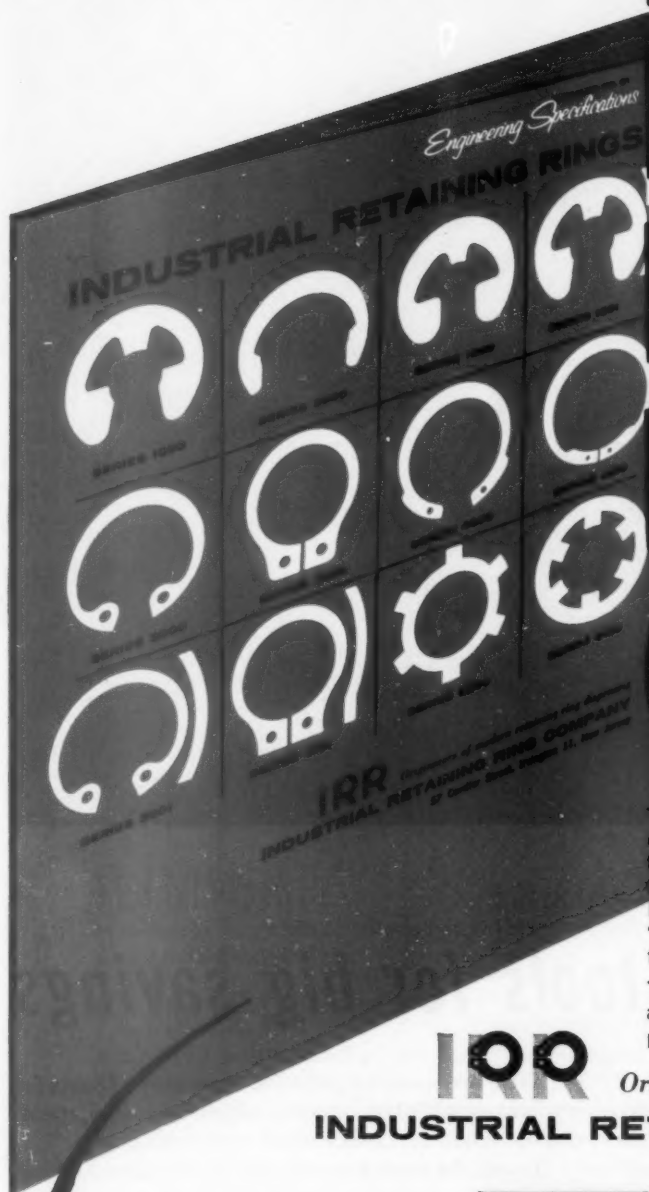


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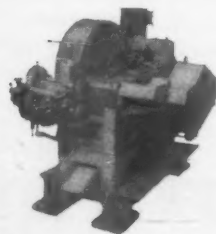
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BETTER DESIGN AND ENGINEERING FOR ASSEMBLY

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LOOKING AHEAD

Among the articles coming up in the next few months are the following:

- Designing for cold-headed fasteners
- Expansion assembly techniques
- The application of reliability to new products

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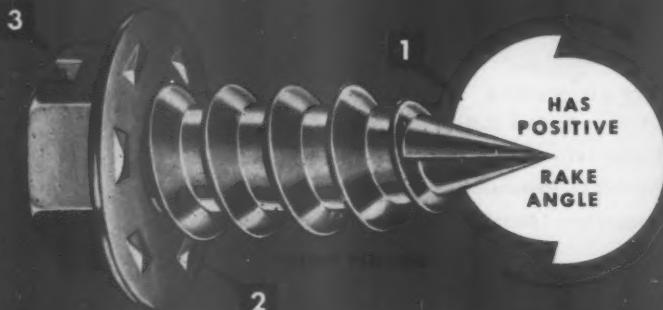
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CENTRAL SCREW COMPANY

Letters to the Editor

Stud Welding

The article, "The Role of Stud Welding in Product Design," in your July issue is of interest to us.

In the article it is stated, "The equipment can handle a full range of stud sizes—No. 2 to 1/4" diameters and from 3/8" to 5 1/2" in length."

Can you arrange full details of this equipment to be sent to us, or advise where we may obtain such information?

**J. B. Hall, Mfg. Engr.
Radio Electric Works
Amalgamated Wireless Ltd.
New South Wales, Australia**

• Contact the author, Frank Wille, at Omak Industries, Inc., 9701 S. E. McLoughlin Blvd., Portland 22, Oregon.

Industrial Robot

Please send us the name and address of the manufacturer of the "industrial robot" featured on page 41 of your August issue.

**LaVerne Schaeffer
Ram Tool Corporation
Chicago, Illinois**

• The company is U.S. Industries, Inc., 250 Park Ave., New York 17, N.Y.

Threadless Screw vs. Nail

In a recent column, Rudy described "a new product" called a threadless wood screw. Since it resembles a nail, oh so closely, can it be a new product?

**Arthur S. Tisch
Director, Technical Sales
Independent Nail & Packing Co.
Bridgewater, Massachusetts**

• Rudy's only comment is "Touché".

Burr-Like Fastener

The writer has been searching for a fastener . . . whose material is nylon with countless numbers of small loops molded on a flat surface. After molding, the loops are severed on one side. When two pieces of this material are pressed together, they grab.

If you can help in locating the name of the manufacturer it would be appreciated.

**L. R. Kunert
Development Engineer
The Regina Corporation
Rahway, New Jersey**

• Velcro Corporation developed this burr-like fastener which is being marketed by The Hartwell Corporation, 9035 Venice Blvd., Los Angeles 34, Calif.



**NEW PRINCIPLE
IN TORQUE
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Rotor announces J-42T torque control air impact wrench with new hydraulic amplifier

- **NEW** unique hydraulic amplifier shuts off tool at desired torque. This exclusive device results in...
- **FASTER** rundown and impacting speed. Cuts job time.
- **MORE ACCURATE** torque control with uniform results. Quick, easy adjustment...tamperproof.
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TAPPING SCREW

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Square point provides 4 points of contact • Starts straighter • Offers chip-free driving • Low drive torque with high strip torque • Resists vibration... won't loosen • Uses same lead hole • Replaces most types of thread-cutting and thread-forming screws... simplifies inventory... assures better price break.

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Assembly & Fastener Engineering

THE EDITOR'S VIEW

NOVEMBER, 1961, VOL. 4, NO. 11

A PANACEA FOR THE ENGINEERING SHORTAGE?



In many large companies, far too many men with engineering degrees are sitting at drawing boards doing the work of skilled draftsmen, instead of devoting their time to creative work. This misapplication of talent, coupled with the fact that fewer students are enrolling in engineering schools, has been the cause of considerable worry by those concerned with our technological pace.

But there is a ray of hope that perhaps we need not be so concerned about this matter. This stems from a new engineering method developed by a firm of engineering consultants (see page 19). In a demonstration of this technique, witnessed by yours truly, engineers at drawing boards were conspicuously absent.

With this new method, called the panoramic design technique, engineers and designers work together at a wall-sized blackboard. Each man is assigned a specific part of the design to develop and his ideas are constantly on display.

It's true that the method has one disadvantage for inherently lazy en-

gineers and designers. It forces them to work, instead of daydreaming at the board or musing for days over an idea before lifting a pencil.

But on the other hand, it must be admitted that board work is not exactly conducive to creativity, and the blackboard technique may be just the medium for those engineers and designers seeking more creative work.

This panoramic technique is certainly worth a close scrutiny by companies seeking to make more profitable use of their own engineering talent.

For those concerned lest the widespread adoption of this technique may result in wholesale layoffs of engineering draftsmen, we wish to point out that this technique can help slash the lead time on new products, releasing creative engineers for work on thousands of undeveloped ideas.

The faster that more engineering talent can be released for creative work, the sooner that more new products can be placed on the consumer market to keep our economy humming.

Dr. E. Hensley
EDITOR



CP ANGLE NUTRUNNERS. Top, Angle Nutrunner CP-3090-ATN. Below, CP-3017-ATN. Jolt-free. Easy to hold. Fasteners installed accurately to torque specification. Torque Range: 6 to 200 ft. lbs. Bolt Capacity: $\frac{1}{4}$ " to $\frac{7}{8}$ "



CP NUTRUNNERS. Top, new "Dial Torq" Nutrunner, the only power tool you can "dial in" for the precise torque you want. Below, CP-3018-RMNP, offset handle. Torque Range: 20 to 180 in. lbs. Screw/Bolt Capacity: #8 to $\frac{3}{16}$ "

There's one outstanding characteristic common to all CP "One-Shot" Fastener Driving Tools: the precise torque sensing ability of the tools themselves. Put the tool on the work — press the throttle — and the instant torque is attained all driving action stops. Its torque-awareness is unequalled by any clutch for accuracy and consistency. It will pay you, as it pays the executives in dozens of industries who write us in praise of these quiet, trouble-free tools, to specify CP "ONE-SHOT".



CP "ONE-SHOT" SCREWDRIVERS can save up to 75% in fastener driving time... eliminate stripped threads.



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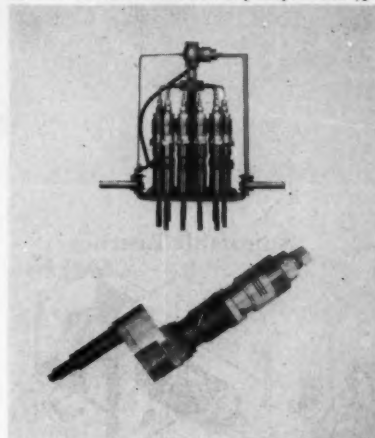


CP ELECTRIC SCREWDRIVERS & NUTRUNNERS. Top, CP-157 Hicycle (220/3/180) Electric Screwdriver. Torque Range: 7 to 100 in. lbs.; Screw Capacity: #5 to 1/4". Below, CP-7156 Super Cycle (220/3/360) Nutrunner. Torque Range: 40 to 180 in. lbs. Screw/Bolt Capacity: #12 to 3/8"

CP SCREWDRIVERS. Top, CP-3008-ORTS with pistol grip handle. Below, CP-3012-LMS with silent exhaust. Torque Range: 4 to 100 in. lbs. Screw Capacity: #3 to 1/4"



CP MULTI-RUNNER MOTORS. Top, 12-spindle Multi-Runner. Below, CP-3075-MMM Multi-Runner Motor with offset spindle. Torque Range: 1/2 to 310 ft. lbs. Screw/Bolt Capacity: #4 to 1/4"



Here's how 4 companies
eliminate work spoilage,
end field complaints with

CP "ONE-SHOT" TORQUE CONTROL FASTENER DRIVING TOOLS

The 4 case histories described below are typical of hundreds of examples† that prove CP "One-Shot" torque control fastener driving tools can save money for you . . . eliminate rejects . . . end field complaints.

A soft pull-up job: A gasket under the handle of a home appliance represented a severe soft pull-up . . . two screws are involved . . . torque specified of 20 inch-pounds ± 5 were difficult to meet, handles were cracking. Setting the CP "One-Shot" Screwdriver clutch to the desired torque enabled manufacturer to meet specifications . . . all readings are 20 inch-pounds.

Reduces spoilage 80%: Manufacturer of a control drives four #8 cover retaining screws into tapped plastic housing. Maximum desired tightness: 7 inch-pounds; stripping torque:

9 inch-pounds. A change to CP "One-Shot" Screwdrivers cut housing spoilage from 10 per hour to 2 per hour, with no sacrifice in work rate.

Keeps repair costs low: Yearly maintenance records at an electronics plant reveal that 30 CP "One-Shot" Screwdrivers have been kept in operation at an average repair cost of only five cents per tool per month. A perfect combination of low cost performance and high level precision.

Ends field complaints: Assembling an office equipment unit with #10-32 frame bolts, manufacturer was getting readings from 20 inch-pounds to an excess of 30. Switch to CP "One-Shot" gave uniform readings of 28 inch-pounds, and ended field complaints.

†Details and names of companies are yours on request.

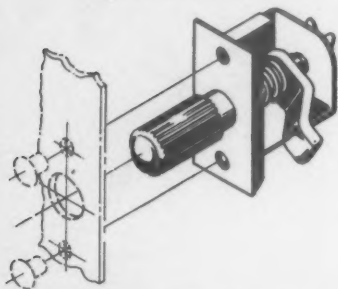
CP manufactures the most extensive line of "one-shot" tools available today. Let a CP Torque Control Specialist help you solve your fastener driving problems. Chicago Pneumatic Tool Company, 8 East 44th Street, New York 17, N. Y.

It's a good design, but how will you fasten that panel?

Design a package that no standard fastener will fit, and you'll need a special device. We design and build specials. But standards (like those shown here) cost less and get there sooner.

36 pages of standard fasteners in our new Handbook No. 11 Send for one... it's free. Write Southco, 257 Industrial Highway, Lester, Pa.*

Adjustable Fastener



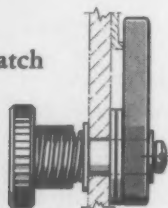
Best Application: To compress a gasket, resist vibration, fit varying frame thicknesses.

Form: One piece latch installed by passing knob through door. Quarter turn opens or closes. No striker required.

Features: Further turning of knob changes grip to hold different frame thicknesses, tightens door against gasket.

Availability: From stock in 4 sizes, miniature to large. *Handbook pp. 28-37.

Panel Latch



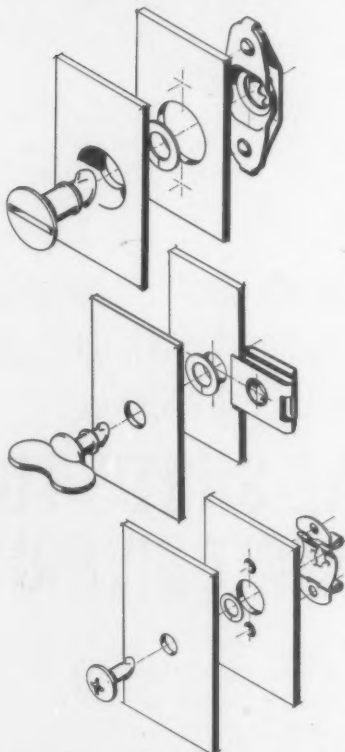
Best Application: Where spring loading, single hole mounting, and minimum inside clearance are factors.

Form: Chromed knob with arrowhead to indicate pawl position. Spring in plated ferrule applies tension to pawl.

Features: Uses only $\frac{3}{16}$ " inside space. Pushing knob relaxes operating tension.

Availability: From stock, individually packaged. *Handbook pg. 43. Other latches, pp. 38-43.

Lion 1/4 Turn Fastener



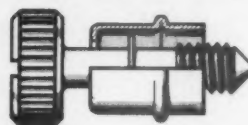
Best Application: For light weight, quick operation, vibration resistance. To meet Mil Spec. MIL-F-5591A (ASG).

Form: Swaged nose stud, retainer (to captivate stud), solid leaf receptacle.

Features: Quarter-turn clockwise locks, quarter-turn counterclockwise unlocks. One piece stud design adds considerable strength. Clip-on receptacle speeds installation.

Availability: From stock in variety of head styles. Ten receptacles offered over the three sizes, including side-mount and casting mount. *Handbook pp. 9-18.

Retractable Screw Fastener



Best Application: Drawers, slides, doors, especially on electronic equipment.

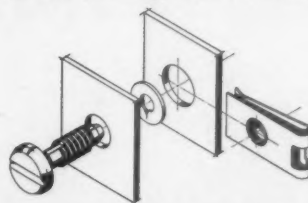
Form: Polished stainless steel screw retained in standoff flanged into door. Screw engages tapped hole in frame.

Features: Screws can be used in multiples, operated individually without forcing door. Float of screw in standoff tolerates misalignment.

Availability: From stock in 5 head sizes (slotted or unslotted), 8 thread sizes from $\frac{1}{4}$ -20 to 4-40. Spring loading for automatic retraction also from stock.

*Handbook pp. 18-22.

Quick-opening Screw Fastener



Best Application: Where misalignment is present, or where doors may be subject to hard use or deformation.

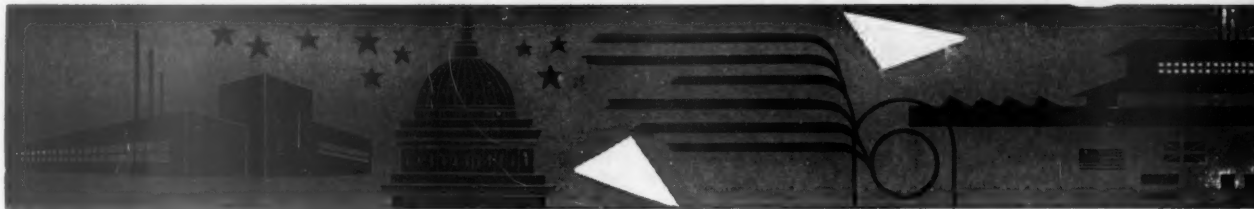
Form: Heavy square-threaded screw assembly held in outer panel by retainer and engaging receptacle on frame.

Features: Maximum float for ease of installation and alignment. One assembly fits variety of door and frame thicknesses.

Availability: From stock in Nos. 2 and 7 sizes. Three head styles; riveted, welded, clip-on receptacles. *Handbook pp. 23-27.

SOUTHCO FASTENERS
LION

The State of Business



Patents Pace the Space Age

by Robert R. Lent, President,
Strategic Industries Assn.

Creative technical ideas have always been America's most noteworthy commodity. The great inventions of history have come from the United States because under our political and economic system the new idea has always been the key to progress and the real objective of our educational, industrial and scientific efforts for 172 years.

If we are to have an American on the moon before this decade is past, it will necessitate a vast outpouring of ideas, including innumerable scientific breakthroughs. Beyond question, this national effort will far exceed any other single program in our history and will demand the greatest possible measure of our technical creativity.

When our forefathers organized themselves for the founding of our nation, they correctly forecast the vital role of creativity in building its strength by providing, in the First Section of the Constitution, its encouragement and recognition.

Our first patent law was enacted in 1790. This, I think, is indicative of the urgency they attached to this provision of the Constitution. The citizenry were equally alert, and our first three patents were issued in the closing months of that same year.

The patent law has been revised many times, and for a long period, some parts of the law were changed every two or three years. The latest revision of the patent law by Congress was in 1952. These revisions illustrate how very important the Congress considered the constitutional provision.

The extent to which this carefully tailored patent system has unleashed the creative technical abilities of our people is charted in Figure 1. I have chosen to plot applications, rather than patents issued, since the translation of an application into a patent is largely a legal process. The patent application itself represents more closely a measure of creativity.

The economic consequences of this flow of creative technical ideas is shown in the dotted black line. This is a plot of our Gross National Product, reduced to productive output per man year.

We see that the steadily increasing production of new ideas has been paralleled by a steadily increasing productivity of our national effort. When idea-production faltered, so did our productivity. With the coming of World War II, our idea-generation again rose, and our productivity began a very steep climb. It reached an average of \$6,934 of output for each worker in 1960.

With our steadily and rapidly expanding population, an increase in patent applications is to be expected.

In Figure 2, the per capita generation of new patent ideas, and the value of a patent are plotted.



Lent, following 20 years of Aerospace experience, now heads his own marketing and consulting firm. He has appeared before numerous Congressional investigating committees, representing the small subcontractors' views for Strategic Industries Association. He is the association's newly elected president.

Here the picture is different. We see a surprising and dangerous fact that our technical idea generation, as expressed by the volume of patent applications, is at an all time low over the past 20 years. Today our people are producing new technical ideas at a rate far below that of the hard-working citizens of 1870!

Despite the 170 years of building our patent system through the wisdom and care of 87 Congresses, only about one out of every 2000 citizens, on the average, produces a new technical idea expressed in the form of a patent application.

Yet, the value of a patent today is more than 20 times its worth a century ago.

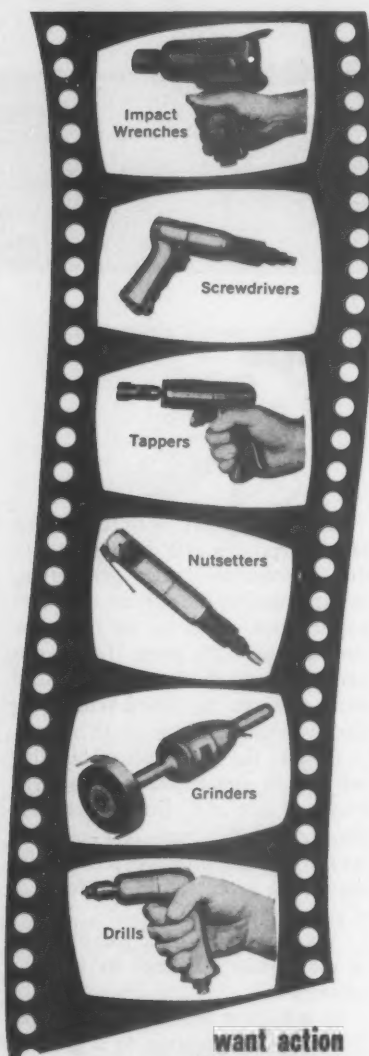
It is against this background that I draw your attention to a growing artificial barrier to our technical creativity. A barrier created by those who simultaneously exhort us to a greater and greater idea generation.

Patent application reached a peak in 1930, which has never been topped. I would suggest the culprit in the matter is that in 1930 the first patent was issued directly to the U. S. Government. The number of government owned patents has grown steadily since 1930, almost in proportion with the decrease in public applications.

The last statement on government patents issued was for the year 1957. Since that time, the government says that the figures on its patent awards are "not available."

The concept of a government-owned patent is an anachronism at best. The legal definition of a patent is: "the right to exclude others from

continued



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Airetool production tools . . . engineered to deliver the power and accuracy you want; constructed to stand up under 3-shift operation; designed for easy handling and speed; built for long life and easy maintenance. See them demonstrated right in your own shop . . . call your Airetool representative . . . there's no obligation.

Representatives in principal cities of
the free world



Business, continued

making, using or selling" that described in the invention. Our government can hardly be in the position of excluding others from making, using or selling that described in its patents. The government itself does not make, use or sell such inventions.

Presently under consideration in Congress is a bill which states: "Notwithstanding any law, custom, usage or practice to the contrary, no invention resulting from a research contract or grant financed by the United States shall be patented other than in the name of the United States and no patent resulting from such a contract or grant shall be issued, assigned, or otherwise transferred to any person, corporation, or association as compensation under any such contract or grant"

Needless to say, to administer the provisions of this bill, a new government agency would be established, which would have the right to look over each new patent before it is issued to determine whether it would like to keep it or not.

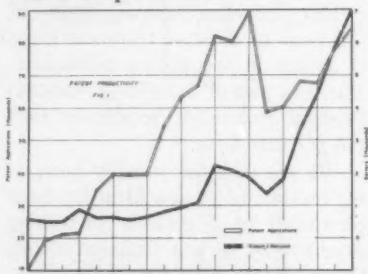
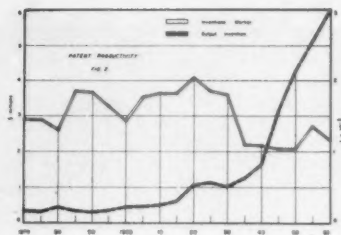


Figure 1 compares patent applications to gross national product, (dotted black line) reduced to per-man-year basis, and shows parallel characteristics of patent applications and increased GNP.

Even if a person invented a device which proved to be the proverbial "better mousetrap," if he or his company were doing work under a government contract, the government would have the right to say whether he could use it, make it, or sell it.

These proposed acts of Congress are striking hard at the very well-spring of our national ability to place an American on the moon in this decade. They will dam up the flow of new technical ideas, through not only the threat but the detailed procedure for government usurpa-

The Strategic Industries Association is comprised of independent subcontractors serving national defense. It has been active in defending patents and protecting the small firms proprietary rights.



Dotted line black line in Figure 2 shows increasing value of patent, while light line shows the volume of patent application made in the last 90 years.

tion of the patent privilege of the citizen. A privilege initially granted by the Constitution. These proposed acts can not only handicap, but paralyze our scientific assault on the moon and the planets.

We must recognize that the sciences have accelerated their growth to the point where even its everyday terminology is inexplicable to the layman. It is tragic therefore, that in our rapid pace, we are inadvertently leaving behind in comprehension the very people who must sit in judgment of our efforts: the Congress.

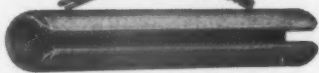
Only creativity can lift an American into space. Only the incentive of financial reward and recognition can foster creativity. The farseeing concept of our Constitution, the countless court arguments and decisions, helped mold an equitable patent law. Our economic achievement through a flow of patentable ideas has given this nation the strength of freedom and individual rights utterly essential to the challenge of space exploration.

As we set out on the greatest scientific adventure in our history, perhaps we should pause and write down the laws by which we will guide ourselves.

History has shown the essential role of the patent privilege in the progress of our industry and our society. It should be clear that it will be through a simple re-affirmation of our Constitutional patent privilege that the way will be swept clear of artificial barriers to the unbounded flow of new technical ideas.

This privilege has brought us from a wilderness to the world's most advanced society. Carefully preserved and strengthened, it alone can take us to the moon and to the far planets of our universe.










WHERE CAN YOU USE
THIS SIMPLE FASTENER?



ROLLPIN is the slotted tubular spring pin with chamfered ends that is cutting production and maintenance costs in every class of industry. Drives easily into standard holes, compressing as driven. Spring action locks it in place—regardless of impact loading, stress reversals or severe vibration. ROLLPIN is readily removable and can be re-used in the same hole. Made in carbon steel, corrosion resistant steel and beryllium copper.

"WHERE SHOULD YOU BE USING ROLLPINS?"

Thousands of companies—from cigarette lighter makers to car manufacturers—have learned from experience that ROLLPINS not only cut production and assembly costs, but make good products even better! The 9 examples pictured below don't even begin to indicate the range of application and usefulness of this simple, universal fastener. And naturally, they don't begin to show the cost and production savings you can achieve with ROLLPINS. If you aren't using ROLLPINS now, shouldn't you be? Write for a generous sample assortment and complete information. Dept. R62-1197.

I	 <p>REPLACING A GROOVED PIN . . . here Rollpin serves as a stop pin. Its light weight and shear strength function perfectly . . . cuts assembly costs.</p>	T	 <p>REPLACING A SET SCREW . . . a short length Rollpin is self-retained in the handle of an automobile brake. Is readily driven into over-drilled hole in shaft for easy removal.</p>	T	 <p>REPLACING A HEADED PIN . . . in this hinge pin application, constant spring tension holds Rollpin firmly in place . . . eliminates loosening of hinge due to wear.</p>
I	 <p>REPLACING A RIVET SHAFT . . . Rollpin serves as an axle for the sparkwheel of a cigarette lighter. No riveting or threading necessary. Faster assembly.</p>	T	 <p>REPLACING A CLEVIS PIN . . . here Rollpin holds firmly in clevis, permits free action of moving member.</p>	I	 <p>REPLACING A HUB ON A GEAR . . . Rollpin, self-retained in shaft, is simply snapped in to molded slot to position sintered gear. Rollpin's shear strength is particularly valuable here.</p>
I	 <p>REPLACING A COTTER PIN . . . Rollpin assembly time is shorter, service life ten times longer. Vibration-proof flush fit. Easily removable.</p>	I	 <p>REPLACING TAPER PINS . . . Rollpin eliminates cost of taper pin reamers and the entire reaming operation. Rollpin costs less than a taper pin and installation is cheaper.</p>	T	 <p>REPLACING A BOLT AND NUT . . . Rollpins act as fasteners and pivots . . . may also be used with a free fit in outer or inner members depending upon product design requirements.</p>














ELASTIC STOP NUT CORPORATION OF AMERICA










2330 Vauxhall Road, Union, New Jersey

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WALDES TRUARC® RETAINING RING

function		for axial assembly					for taking up end-play					
nomenclature		basic		heavy duty	inverted		axial assembly		radial assembly			
												
series no.		5000 N5000	5100	5160	5008	5108	N5001	5101	5002 N5002	5102	5131	5139
application		Internal for Housings, Bores	External for Shafts	External for Shafts	Internal for Housings, Bores	External for Shafts	Internal for Housings, Bores	External for Shafts	Internal for Housings, Bores	External for Shafts	External for Shafts	External for Shafts
size range	in.	.250 - 10.0	.125 - 10.0	.394 - 2.0	.750 - 4.0	.500 - 4.0	.250 - 1.500	.188 - 1.500	1.0 - 10.0	1.0 - 10.0	.110 - 1.375	.092 - .438
	mm.	6.4 - 254.0	3.2 - 254.0	10.0 - 50.8	19.0 - 101.6	12.7 - 101.6	6.4 - 38.1	4.8 - 38.1	25.4 - 254.0	25.4 - 254.0	2.8 - 34.9	•

function		for radial assembly				self-locking types					
nomenclature		crescent™	e-ring	interlocking	reinforced e-ring	circular self-locking		grip-ring	triangular self-locking	triangular nut	
											
series no.		5103	5133	5107	5144	5115	5105	5005	5555	5305	5300
application		External for Shafts	External for Shafts	External for Shafts	External for Shafts	External for Shafts	External for Shafts	Internal for Housings, Bores	External for Shafts	External for Shafts	With Threaded Screw
size range	in.	.125 - 2.0	.040 - 1.375	.469 - 3.375	.094 - .562	.094 - 1.0	.094 - 1.0	.312 - 2.0	.079 - .750	.062 - .438	•
	mm.	3.2 - 50.8	1.0 - 34.9	11.9 - 85.7	2.4 - 14.3	•	•	•	2.0 - 19.0	•	•

Truarc retaining rings are precision-engineered fasteners which simplify design, speed production and reduce material, machining and assembly costs. They may be used to retain components on shafts and in bores and housings .040" to 10" dia. — and rings as large as 40" dia. have been developed for special applications! Truarc rings are installed in easy-to-cut grooves and self-locking types are available which do not require any preparatory machining. Altogether, there are 50 functionally different types . . . some with as many as 98 sizes . . . in 6 metals and 13 finishes.

More than a fastener! Truarc rings function as mechanical components by replacing machined shoulders, set collars, rivets, threaded fasteners and other bulkier and more expensive fastening devices. They

eliminate drilling, tapping, threading and other costly machining operations. Speed of assembly and disassembly further reduces manufacturing costs and simplifies field service.

Assembly tools for every requirement: Truarc offers you the most complete line of pliers, applicators, dispensers and portable magazine-fed tools for high-speed ring installation . . . even fully mechanized and automated equipment for mass-production assembly operations.

Engineering Service: We'll be happy to help you solve *your* fastening problems. Send us your blueprints or contact your local Truarc representative or distributor. They're listed in the Classified Telephone Directory under "Retaining Rings" or "Rings, Retaining."



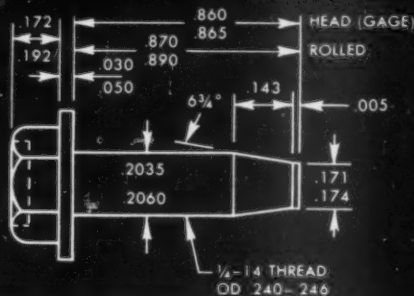


300% UPSET



MIDLAND

Fasteners



... crucial cold heading done with KEYSTONE WIRE

To upset an indented hex washer head sheet metal screw with a thin washer 300% larger than the original wire diameter calls for good tooling and superior quality wire. Such a screw is cold headed on a 2-blow header by Midland Screw Corporation, Chicago, Ill., from Keystone Special Process Wire.

Ed Wick, Customer Service Coordinator, has exceptional praise for Keystone Wire. He says, "In cold heading this sheet metal screw we have had our best success with Keystone C-1018 Special Process Wire. We like to work with this wire. A big factor in its selection is the uniform quality throughout the coil, correct thermal treatment and flowability characteristics—as well as excellent service and dependable deliveries from Keystone Steel & Wire Company."

If you are looking for a high quality wire with delivery you can rely upon, it will pay you to investigate Keystone Special Process Wire.

Keystone Steel & Wire Company, Peoria, Illinois



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KEYSTONE

WIRE FOR INDUSTRY
MADE AT PEORIA, ILLINOIS, U.S.A.

***This "Christmas Tree"
is a special
fastener***



This unique special fastener, used to compress laminated wood beams during the gluing process, was dubbed "Christmas Tree" by the workers in a Bethlehem fasteners plant. It was developed after more than a year of work with the customer's design.

We have turned out a large number of "Christmas Trees" for American Fabricators Company of Bellingham, Wash., who reports that each tree does 30 per cent more work than anticipated. Substantial savings in material

and labor costs result because larger beams can be handled, and the fasteners can be spaced farther apart during the gluing process.

It's quite possible that we can make a cost-cutting special to replace an assembly you are now using. Just send us a drawing, sketch, or sample, with a description of the job it's expected to do. We'll give you an honest appraisal of what we can do.

Get in touch with the nearest Bethlehem office, or write to us in Bethlehem, Pa.



*for Strength
... Economy
... Versatility*

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. Export Sales: Bethlehem Steel Export Corporation

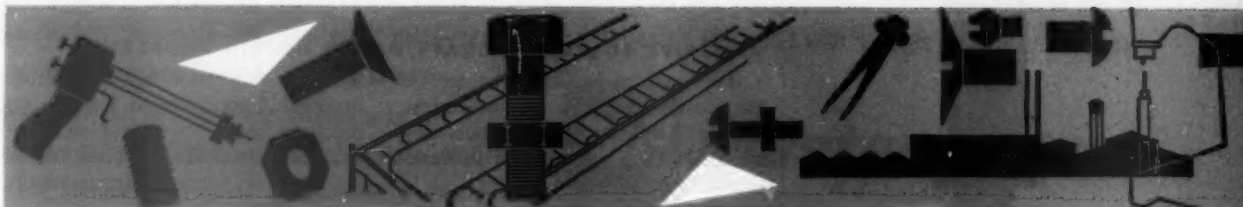
BETHLEHEM STEEL



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Assembly & Fastener Engineering

Ideas and Field Reports



PANORAMIC DESIGN CUTS LEAD TIME ON NEW PRODUCTS

An engineering technique which cuts lead time on new products by eliminating most conventional drawing work has been unveiled by a Chicago consulting engineering firm, TAB Engineers, Inc.

Called the "panoramic design technique", the method virtually does away with drawings made by using drawing boards, parallels and T-squares. Instead, designs are put directly on wall-size blackboards,

then photographically recorded, according to C. E. Evanson, the firm's president.

In its own use of the method to complete projects for clients, TAB reports that it has slashed both cost and time by about 50%.

On a special packaging machine for a food processor, TAB estimated it would take six months and \$80,000 to engineer and build the machine conventionally. Using the

panoramic design technique, the completed machine was delivered in 90 days at a cost of \$48,000.

The technique was developed by H. A. Edmonds, vice president and director of engineering, who likens the method to "brainstorming."

"In conventional engineering practice, the individual designer made drawings of his ideas on his drawing board, and then submitted them for approval or revision," Edmonds explains. "There could have been as many as 10 or 20 engineers and designers working on parts of a design at the same time, and the chief engineer had to look at their work individually.

"When the basic design was developed, the work was turned over to detailers who then spent hours preparing the detail and assembly drawings for use in making a pilot model.

"Our own time records show that an average of 78% of the engineering time previously spent on a project was devoted to layout, detailing and revisions. This same drafting work using the new method is slashed to 34%," reports Edmonds.

With the new method, engineers and designers work together as a group at a huge blackboard. Each man is assigned a specific part of the design to develop, and his ideas are constantly on display as he progresses.

The director of engineering or project manager can see the project in its entirety instead of inspecting individual drawings one at a time.



Engineering room without drawing boards. Engineer at left discusses proposed design with supervisors at the table. In background, photographer is making photograph of approved design for permanent record.



THE HEAT'S ON

And difficult fastener problems are solved

New one-step, "touch and go" blind expansion riveting takes just a touch of heat and the job is done . . . *instantly!*

Developed by DuPont, this new idea in fasteners is safe, simple and economical. All you need is a soldering iron.

- One unskilled operator can set up to 25 per minute.
- Fasten metal, wood, rubber, fibreboard, plastic, tubing, etc.
- No expensive tooling — all you need is a soldering iron.
- Safe, positive sealing; shank expands along full length for wider grip range.
- No finishing operation required.
- Simple, one-piece design.
- Brazier or countersunk head.
- Available in brass, chrome plated brass, aluminum, stainless steel.
- Tamper proof.

Send for details

THE BOWMAN PRODUCTS CO.

Industrial Division

850 East 72nd St. • Cleveland 3, Ohio

Exclusive distributors:



Industrial Blind
Expansion Rivets

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Ideas and Field Reports, continued

If a change is indicated, it can be made just by erasing the chalk and sketching a new version.

TAB estimates that if the new technique were universally adopted,

private industry and the government could slice at least \$6 billion from its estimated annual \$22 billion engineering, drafting, and research and development expense.

ADHESIVE SOLVES AIRCRAFT PATCH REPAIR PROBLEMS

To repair superficial damage to the costly interiors of jet liners, Boeing Airplane Co. engineers developed a basic patch-repair process, using Eastman 910 Adhesive.

The process, developed at the Boeing Seattle plant, included techniques for repairing holes in vinyl-aluminum bonded panels and for re-bonding of polyvinyl chloride extrusions and molded parts used in the passenger cabin interiors.

Restoring the deep-textured decorative vinyl designs without blemish

is not an easy task. The deep-texture makes it impossible to feather out patching resins by sweeping. Mechanical external pressures, either clamping or vacuum, are generally impractical to apply to a completed airplane. Speed in curing was a major requirement.

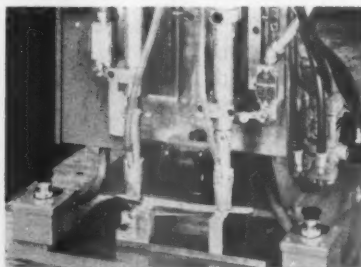
In the search for an adhesive that would meet the requirements of the patch-repair method, it was found that the 910 adhesive met Boeing's requirements for this repair technique.

AUTOMATIC STUD DRIVER CUTS ASSEMBLY TIME

An automatic stud driver, built by Clyde Engineering and Manufacturing Co., halved the assembly time of an automotive part. The unit automatically feeds, orients and drives different sized self-tapping studs in a fender ornament casting. One head drives a self-tapping stud to a required depth, and another head drives a shouldered stud to a required torque.

The bench mounted machine operates on normal shop air pressure, and requires only one air intake.

To operate the unit, the part to be assembled is manually loaded onto a fixture. When the machine is actu-



ated, fixture clamps position the assembly and start the machine cycle. After driving the studs, a limit switch releases the clamping fixture, and the driving heads return for reloading. The approximate cycle time for the operation is about 2 seconds.

UNIT TEST, CODES AND CLASSIFIES COIL SPRINGS



A coil-spring testing unit, built by RCA Industrial and Automation Division, automatically checks, classi-

fies and color codes transmission main oil pressure regulator valve springs. It is installed at Ford Motor Co.'s Livonia plant, and is capable of checking up to 600 springs an hour.

The unit, an electro-mechanical device, is designed to insure quality and improve the performance of automatic transmissions. It automatically classifies acceptable springs into three categories within a total weight tolerance of one pound. Loading and unloading is done manually.

Out-performs, out-lasts ANY wrench its size!

And we can prove it! This new Model 951 $\frac{3}{4}$ " heavy-duty wrench does more of the tough bolting jobs with power to spare! It'll tighten a $\frac{1}{2}$ " high tensile bolt to ultimate yield point in 3 seconds. Its extra power and durability comes from an all-new impact unit with "Rollaction" clutch coupled directly to the motor—no springs, no gears, no lost motion. There are three points of impact. The impact unit is sealed in oil, suspended on ball bearings and controlled by positive ball and cam timing. So simple—only five major parts—you can take the entire tool apart with a single Allen wrench. So rugged—with hardened steel at all points of wear—you'll get more work out of it, put less maintenance into it. And it features MP's exclusive push-button reverse. Model 951 is our all-time engineering achievement. Test it against any competitive impact wrench. Call your MP distributor or mail us the coupon below.

MP **Master Power**
A subsidiary of
Black & Decker®



Master Power Corporation, Dept. B-11
Solon, Ohio

() Please rush me complete information
on your new Model 951 Heavy-Duty Impact
Wrench.

Name.....

Title.....

Company.....

Address.....

City.....Zone.....State.....

() Call me. I'd like a demonstration.

what? all these *Snap-on* sockets to drive just one size nut?



yes — AND HERE'S WHY: Every $\frac{3}{4}$ -inch socket shown here solves a particular industrial nut-running problem. *Snap-on* makes this variety of $\frac{3}{4}$ -inch hex wrench sockets and many more sizes and styles to give you just the one you need to match the job you have to do. Standard length, bolt clearance length, magnetic, Flexockets, power, power-impact and thin-wall types let you choose the socket to do your job faster and more efficiently, with less breakage.

ASK YOUR *Snap-on* MAN — If you have a production or maintenance problem involving special socket design or application, or any other question on tools, talk it over with your *Snap-on* man. He is a specialist who devotes all his time to industrial application of *Snap-on* tools. Write us or call your nearest *Snap-on* branch. Free catalog of industrial wrenches and hand tools is yours for the asking.

FOR ALL INDUSTRY
SNAP-ON TOOLS
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Ideas and Reports, continued

TOLERANCE CHECKS UP TO 10,000 PARTS PER HOUR

A small parts inspection machine, built by Synthane Corp., sorts and checks up to 10,000 parts per hour for adherence to tolerance.



The unit shown was originally designed as a quality control check for automotive parts, and has since been adapted for inspection of other small parts. It was designed and developed by Joseph Staub, superintendent of the company's automatic screw machine department.

It was built originally as a quality control check for rubbing blocks used in automotive ignition components. It has since been adapted for inspection of other small parts manufactured by the company.

In checking the blocks, they are placed in a vibrating hopper which feeds the pieces into a track. They drop of their own weight between the faces of a gage which, in turn, checks each angle for length and drops it into one of two pans. One pan receives the acceptable pieces, the other the rejects.

Performing smoothly and accurately, the unit has contributed to a substantial cost and time reduction in both quality control and manufacturing operations.

FLEXIBLE MAGNETS USED IN APPLIANCE MANUFACTURE

Rubber-bonded permanent magnets, manufactured by the Leyman Corp., Cincinnati, Ohio, are being used in an electric can opener made by the Sunbeam Corp.

The magnets are furnished in a stamped, chromium plated assembly for this appliance by the Amerock Co.

The magnetic properties of the rubber molded unit are equal to pre-



Courtesy of Lake Erie Screw Corp., Cleveland, Ohio

If you have
COLD HEADERS
you need

Ajax-Hogue Wire Drawers

*Here are the Advantages of Drawing Wire
at your Headers*

REDUCES COST OF MATERIAL Highest quality cold headed products from hot rolled stock instead of mill drawn wire.

HEADS EASIER Less tendency for split or cracked heads. Hogue-Drawn wire has a lower yield point.

WIRE ENTERS HEADER STRAIGHT and is not coiled after drawing.

UNIFORMLY ACCURATE SIZE on successive coils.

INCREASES DIE LIFE of heading dies.

CLEAN AND PERFECT COATING - no scratches or scuff.

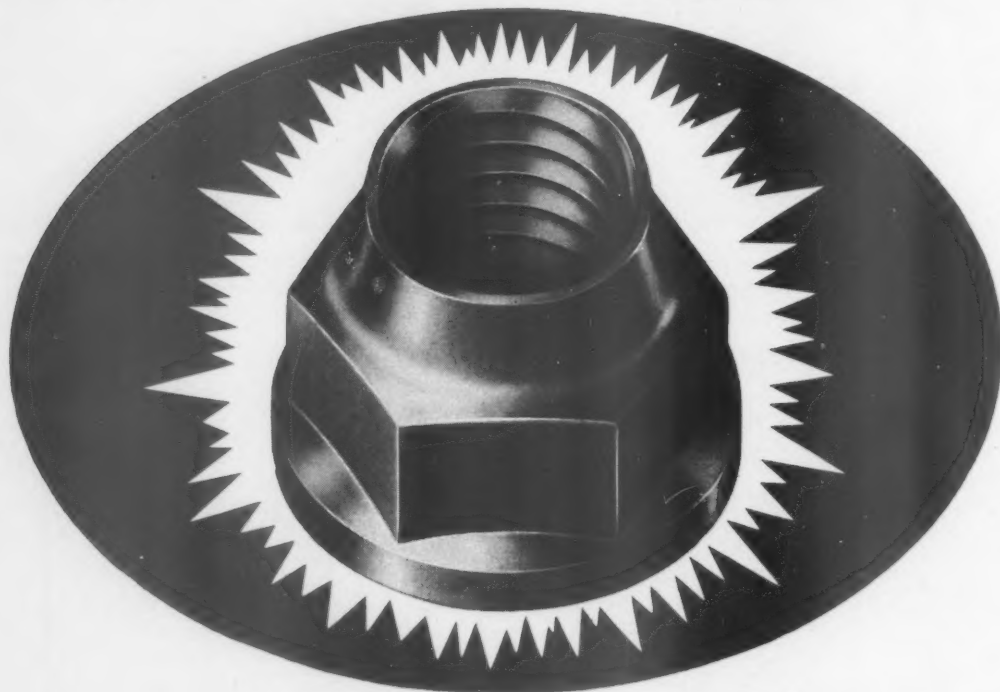
CONTINUOUS DRAWING Rod ends may be welded together.

• Write for Bulletin No. 111-B •

THE ***Ajax*** **MANUFACTURING COMPANY**
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 CHICAGO OFFICE: 110 S. DEARBORN ST., CHICAGO 3, ILLINOIS
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ALLEN introduces

LOKON....



True to its name, the LOKON nut locks on a companion threaded member with a can't-shake-loose grip . . . holds indefinitely against heaviest impact and vibration. Because the basic design allows adequate deformation of the "turret top" without overstressing any portion of the periphery, "LOKONS" are highly resistant to fatigue failure. And, through closely controlled heat treatment, a degree of elasticity is achieved which permits re-use time after time without significant impairment of the locking action.

LOKON locknuts assemble fast and easy . . . start with finger spinning . . . tighten smoothly . . . lock at any point as soon as the threads in

the elliptical section are fully engaged, and are readily removed without damage to the nut or mating part.

Investigate LOKON at the first opportunity. Discover the many ways this major development in locknuts can save you time and cut costs. Test samples* and engineering data are yours for the asking. And, for prompt, off-the-shelf delivery, call your nearby Allen Distributor who carries full stocks of LOKON locknuts as well as dependable Allen hex-socket screw products.

**Currently offered in sizes from No. 10 through 1/2", UNC and UNF threads. Other sizes available soon.*



ALLEN

THE ALLEN MANUFACTURING COMPANY
HARTFORD 1, CONNECTICUT, U. S. A.
Plant at Bloomfield, Conn. • Warehouses in Chicago, Cleveland, Los Angeles



FOR OVER 50 YEARS, MAKERS OF

NEW

... general-purpose LOCKNUT



holds positively tight even after repeated on-off cycles.



provides a "commercial" locknut in the "aircraft" quality range.



offers high strength without bulk for heavy-duty applications.

Only "LOKONS" offer all these extras . . . all without **EXTRA COST!**

ONE-PIECE, ALL-METAL CONSTRUCTION -- The LOKON design requires no segments, inserts or other auxiliary locking devices.

HIGH-GRADE ALLOY STEEL -- Heat treated to Rc 26/30. Imparts tensile strength in excess of 250,000 psi and provides lasting spring tension for unlimited re-usability.

CLASS 3B THREADS -- Comply fully with specification MIL-S-7742 and H-28 Handbook.

BUILT-IN FLANGE -- Large-area bearing surface saves washer cost, speeds assembly, reduces indentation. Face of flange is held square with threads to insure even distribution of stresses throughout the flange and thread area.

DIMENSIONAL ACCURACY -- Allen "pressur-forming" processes control grain flow, hold tolerances to consistently close limits, and produce fully-formed hex corners for sure-grip wrenching.

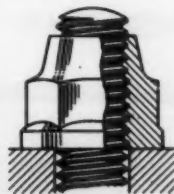
HIGH TEMPERATURE SERVICE -- Performance is unaffected at temperatures to 550°F.

MILITARY SPECIFICATIONS -- LOKON locknuts fulfill the performance requirements of specification MIL-N-25027.

.....

How **LOKON** locks . . .

The threads in the tapered crown of the nut are slightly distorted from the round. When assembled to a companion threaded member, this out-of-round condition causes the nut to resist free entry of the mating part. As the metal flexes in an effort to conform to the circular pattern of the male threads, friction on the flanks of the nut threads is increased. The compressive forces exerted as a result of this diaphragmatic flexing action produce a positive, powerful locking grip.

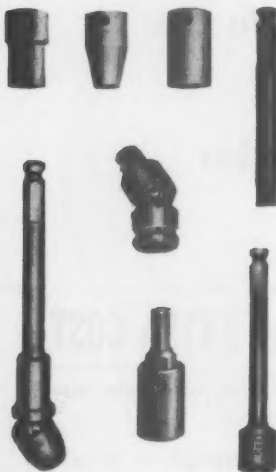


FAMOUS ALLEN SOCKET SCREW PRODUCTS

you may be overlooking one of your best opportunities to

REDUCE INDIRECT COSTS

IMPACT/POWER SOCKETS,
EXTENSIONS, ADAPTERS,
NUT SETTERS, UNIVERSAL
WRENCHES, EXTENSION
UNIVERSAL WRENCHES



In your search for new ways to reduce indirect costs, take a closer look at your fastening tools. These are most likely the busiest tools in your plant, in use hour after hour, day after day . . . and every use offers an opportunity to reduce indirect costs.

Apex fastening tools will help you cut costs every time you drive a screw or run down a nut or bolt. Each Apex tool is designed for use with a specific type and size of fastener. The tool fits the fastener properly, insuring smooth, firm assembly without harming the product or wearing down the tool.

Each Apex tool is carefully heat-treated in Apex' own metallurgical department, insuring the correct degree of toughness and resiliency for your specific application. And every Apex fastening tool is built for continuous, production line use, insuring longer service life with far less downtime for replacement.

There are over 7,000 types and sizes of Apex Nut Running and Screwdriving Tools, for use with all popular makes of air and electric power tools.

NUT RUNNING TOOLS

Catalog 30-A— $\frac{1}{4}$ ", $\frac{3}{16}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ ", $1\frac{1}{2}$ " square drives,
 $\frac{1}{4}$ ", $\frac{3}{16}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " hex drives.

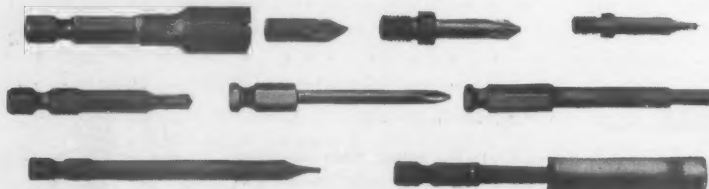
Catalog 30-B— $\frac{3}{4}$ ", 1", $1\frac{1}{4}$ ", $1\frac{1}{2}$ ", $2\frac{1}{2}$ ", $3\frac{1}{2}$ " square drives,
 $\frac{3}{4}$ ", $\frac{1}{2}$ ", $\frac{3}{4}$ " hex drives.

Catalog 30-D—Specials and Spline Drive.

SCREWDRIVING TOOLS

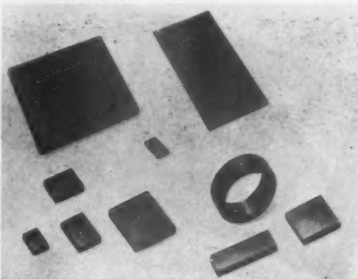
Catalog 30-C—Standard and Magnetic.

BIT HOLDERS, INSERT BITS, POWER BITS,
FINDER SLEEVE ASSEMBLIES, HAND DRIVERS



FASTENING TOOLS

Ideas and Field Reports, continued



Rubber bonded permanent magnets can be made into various configurations. Shown above are a few of the many shapes presently used.

viously used magnets, and do not wear in use. They are dimensionally more uniform.

The magnets can be used for many applications, such as fhp dc motors, radio and television speakers, magnetic chucks and for non-technical uses in toys and novelties.

PIN-IN-PIN FASTENER INCREASES SHEAR STRENGTH

A combination of presently manufactured fasteners is recommended by Standard Pressed Steel Co., to increase shear, bending and fatigue strength of joints where spring pin self-locking fasteners are used.



In application, the hollow cylindrical split-tube type pin is fitted into a similar spring pin of larger diameter. No change in product design is necessary, there is no increase in volume, and a negligible increase in weight.

The principle is being used effectively by manufacturers of farm equipment, power mowers and industrial machinery.

DISPENSER APPLIES SET AMOUNT OF RESIN SEALANT

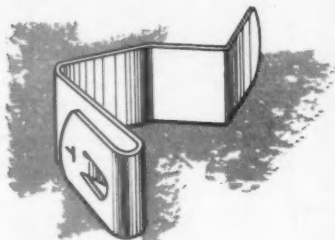
To overcome the problem of applying a metered amount of resin sealant to the adjusting screw of an

INFORMATIVE NOTES TO IMPROVE YOUR PRODUCT... SAVE YOU MONEY

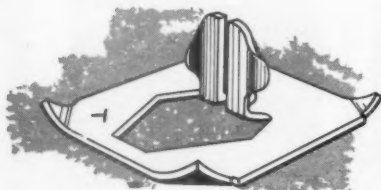
*Published as a service to
Designers and Engineers*

Ideas from Tinnerman have cut costs, improved products. Here are examples from Tinnerman's 10,000 variations of SPEED NUT brand fasteners—all stamped with the T-mark of total reliability.

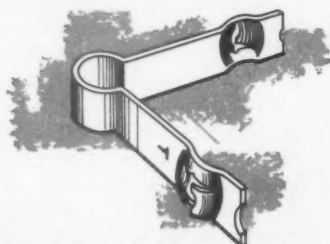
Tinnerman can help you cut costs with a free Fastening Analysis of your product. Call your Tinnerman representative, or write: *Tinnerman Products, Inc., Department 12, P. O. Box 6688, Cleveland 1, Ohio.*



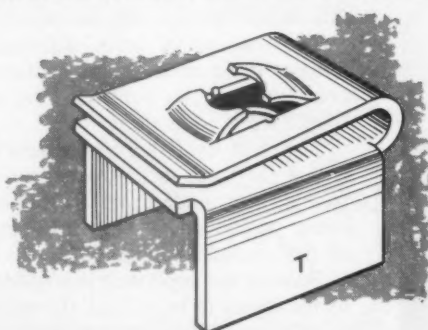
MASONITE PANEL CLIP retains back panel of a TV cabinet, may be applied to many types of covers, panels, access doors, and displays. "U" section locks by hand on panel edge, spring leg snaps over flange of metal cabinet. This SPEED CLIP® fastener *eliminated eight drilling and screw operations, cut assembly time in half*, substantially reduced materials handling for TV manufacturer.



WIND CORD CLIP has wide usage wherever fabric must be fastened to metal panels. Dart-type, self-anchoring tabs snap into wire weave and mounting holes, draw gripping corners down tight. *Assembly requires only thumb pressure.* Allows smoother fastening with fewer parts. First used for fastening insulation cord in car doors.



ANGLE BRACKET fastens mitered corners of extruded aluminum channel sections, *replaces awkward tapped angle bracket.* One of a large line of SPEED NUT angle fasteners. Relieved corners allow for heavy burrs on sawed edges, provide flexibility to offset hole misalignment. Originally designed for storm sash, these fasteners can also be used in picture framing, metal doors and windows, cabinets and display cases.



SPACER SPEED NUT fastener eliminates lockwashers, riveting, welding, staking, clinching, provides clearance for counter-punched holes. Fastener is vibration-proof, self-retaining and easily removable. Built-in spacing legs eliminate separate spacers, *cutting parts handling and inventory, lowering assembly time and costs.* Spacer SPEED NUT fasteners are available in a wide range of sizes.

CANADA: Dominion Fasteners Ltd., Hamilton, Ontario.
GREAT BRITAIN: Simmonds Aerocessories Ltd., Treforest, Wales. FRANCE: Simmonds S.A., 3 rue Salomon de Rothschild, Suresnes (Seine). GERMANY: Mecano Simmonds GMBH, Heidelberg.



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1001
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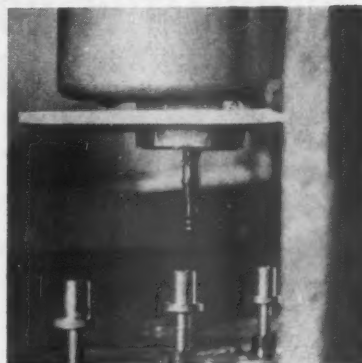
new
UA-300
power writer

UTICA

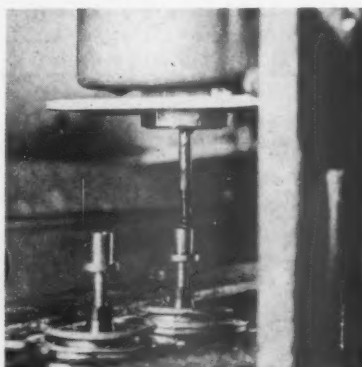
Just as the name implies, the UA-300 Power Writer is a power writing tool. It's a pencil styled, air-activated tool for inscribing, coding, labeling or marking all types of materials such as hard and soft metals, plastics, ceramics and glass. Almost vibrationless, the tool produces readable marks down to $\frac{1}{32}$ ". It operates on a line pressure of 40 to 100 psi. No valves or regulators needed. Each unit is equipped with an 8 ft. air hose. Anyone who can handle a piece of chalk or pencil can write on metal or other hard surfaces with this new tool. Write for price and complete information.

UTICA DROP FORGE & TOOL DIVISION • KELSEY-HAYES COMPANY, UTICA 4, NEW YORK

Ideas and Reports, continued



Above, drop gathers on tip of shaft as it waits for part to be positioned. Grooves in the tip help drop hang on until shaken loose. When actuated by photoelectric cell, shaft is suddenly thrust down to moving thermostat (below), shaking drop loose onto adjusting nut.



automobile thermostat, Standard-Thomson Corp. of Waltham, Mass., developed an automatic dispenser.

It consists of a small reservoir of Loctite sealant, made by American Sealants Co., and a solenoid operated applicator rod. The solenoid is actuated by the interruption of a photoelectric cell by the object to be treated. When actuated, the applicator places a drop of sealant on the thermostat adjusting screw.

The amount of resin delivered remains constant for many applications and can be controlled by a simple screw adjustment.

The chief limitation of the device is that the work to be treated must pass directly underneath the applicator, positioned with an accuracy of half a screw diameter.

Because the applicator is actuated by the object to be treated, the parts do not have to be evenly spaced.

A counting attachment indicates how many applications have been made. Other advantages of the unit are reduced waste in material and

**heat treated
alloy steel nuts**

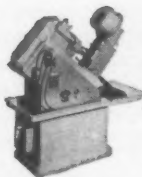
selected and tapped

face  down

within .002"

face run-out

Such accuracy is easily held on Snow machines. They show up best on hard-to-hold, tough steel parts where accuracy and quick changeover are important. They cut production costs, help you to make reliable deliveries of high quality parts. Snow has 3 types of machines for tapping (see below). On your next job let us show you what the Snow method can do. We invite samples and prints.



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Send your blueprints or the fastening job for a prompt, helpful solution to your fastening problems.



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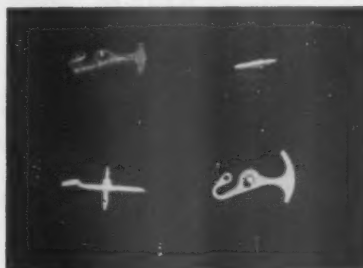
Ideas and Reports, continued

the ability to draw close specifications as to the amount of sealant to be applied.

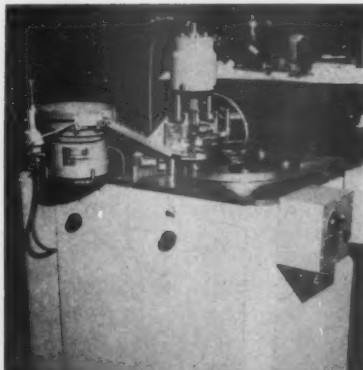
ASSEMBLY UNIT STAKES SHAFTS TO GEAR SEGMENTS

A small parts assembly machine, built by N & N Machine Co., is used to stake shafts to an irregular-shaped gear segment.

A vibrator hopper delivers the shafts to a distributor wheel positioned in line with a staking plunger. Because of the irregular shape of the



Small gear segment, and shaft which is staked is shown above. Below is machine, showing vibratory feeder which orients and feeds shafts to staking unit. Gear segments are manually loaded in locating dies on indexing table.



gear, it is manually loaded in locating dies mounted on an index table.

As gear segments come in line with the staking plunger, the shafts are automatically placed and staked. If a gear segment is missing from a locating die, no shafts are fed, and the staking operation is passed.

After assembly, the finished parts are removed from the dies by locating pins and are conveyed away from the indexing table.

The speed of the machine can be adjusted to accommodate the operator's speed in loading. With minor modifications, the unit can be adapted for a fully automatic operation.

Think Quality...



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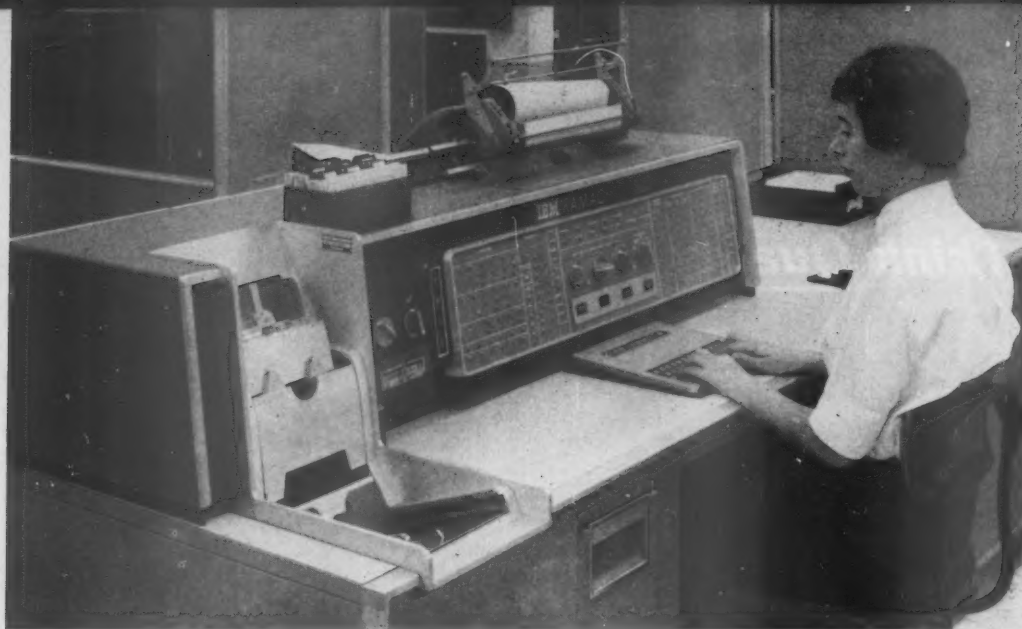
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The brains of automatic assembly control is RAMAC which can store 40 million digits of information.



by **Robert W. Parker**
Head of Industrial Dynamics Systems
Hughes Aircraft Company
El Segundo, California

Assembly Control Through

Part 1

This first of two articles presents the role of data processing in all facets of electronic production at Hughes. Its application to actual assembly work will be further detailed in Part 2.

At our El Segundo division, we produce airborne electronics equipment, including fire control, navigation, guidance and automatic control systems. Each product is highly critical in nature in that its failure at a crucial moment might cost an airplane, several lives, or a million-dollar missile; even worse, it might allow enemy penetration with atomic weapons.

The assembly of these complex products is accomplished by approximately 5000 employees working in a 630,000 sq. ft. plant. The task of turning out a variety of high-quality electronic units on a large scale, by so many workers, poses many problems of planning, scheduling and control. Thousands of detail parts must be made available in the right quantities at the right time, whether they are fabri-



View of portion of the large electronic assembly department at the Hughes-El Segundo plant.

Automatic Data Processing

cated at the plant or procured by purchasing. Tools must be provided, test equipment installed, and assemblies built up in successive stages—all according to closely integrated schedules. Engineering changes and schedule deviations must be processed as quickly as they occur to prevent any disruption in the total manufacturing effort. To control such operations, management of the plant must have accurate and timely information reflecting plant performance at every step of the manufacturing process.

The rapid growth in the scale of manufacturing operations at Hughes-El Segundo during the past ten years has been accompanied by a trend toward shorter runs of increasingly complicated products. Every year brings new problems of control which in turn result in ever

increasing demands for better information systems. Systems originally based largely on manual procedures have been augmented in succession by tabulating equipment, small scale computers, and finally large scale computers and other newly developed data processing devices. The development of these systems is the responsibility of the Industrial Dynamics Department, which includes Systems Analysis, plus Programming and Divisional Data Processing functions.

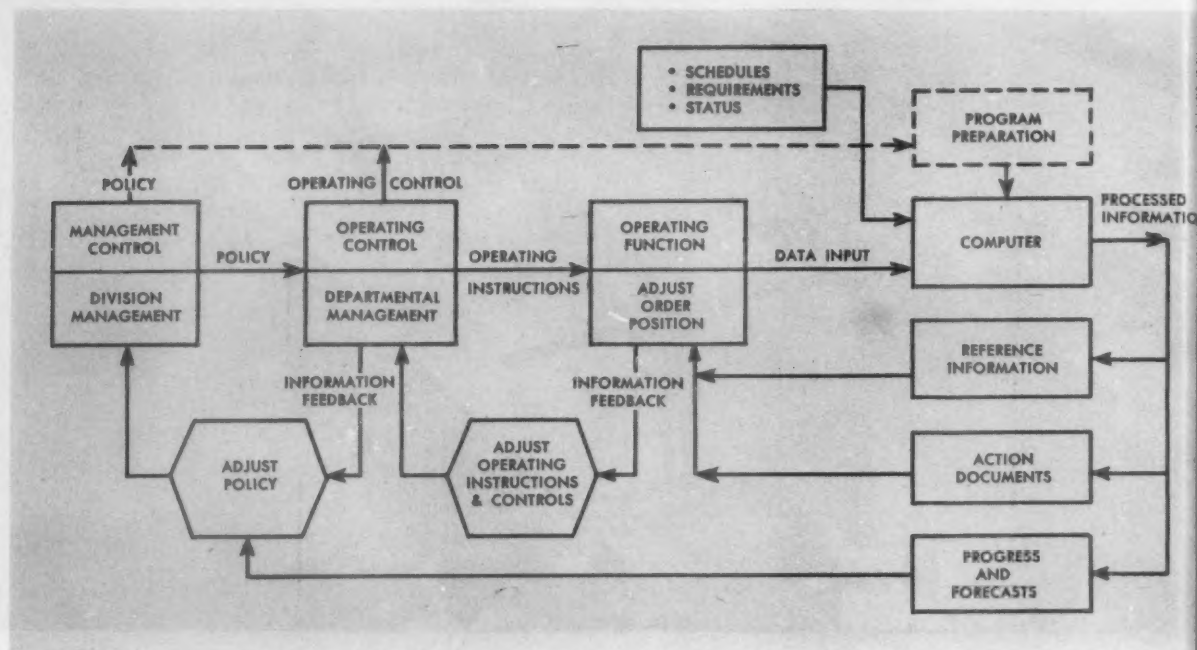
COMPUTER DEPARTMENT

The heart of the data processing system now in use at Hughes El Segundo is the computer department. This includes several large conventional computers along with a double console RAMAC installa-

tion which can do two jobs at once and store up to 40 million digits of information. Less sophisticated machines are available for the more routine jobs. Information is transmitted by means of punched cards, punched tapes, magnetic tape and print-outs, dependent upon its form and manner of usage. The computer department is supplemented by 32 Stromberg Transactor units which transmit localized information to the computer center from throughout the plant. This information gathering installation penetrates every department when action taken on any phase of production will affect the records. When this information reaches the computer center, all records are up-dated and kept current.

The over-all system is built

continued



around the concept of an information loop (see Figure 1). Input information picked up from manually prepared forms, pre-punched cards, or from automatic data collection devices, is converted to punched card form and fed into data processing equipment. The input information is processed in accordance with program instructions which reflect Division policy and Departmental operating procedures. Output is in

[illegible]

affect scheduling, purchasing, parts fabrication, accounting, labor control, etc.

GENERAL ASSEMBLY CONTROL

The control system for assembly mechanizes the information flow from the factory to management and thus provides accurate, timely control over line performance. The system concepts previously used were limited by the time required to transform pertinent production facts into reports. These reports reflected past history rather than current status.

The new system utilizes the latest techniques of data collection and record maintenance. It bypasses clerical bottlenecks which in the past have delayed the reporting of vital production information. Production data is collected by automatic recording devices and funneled into a central data processing system which updates all records affected by the data and reports the changing picture to management on a timely basis.

The 32 Transacter units mentioned previously form a communication network which connects the source of information directly to the data processing system, thereby providing for faster recording and transmitting of inventory and manufacturing data between factory and office. These units are remote transmitters installed in the storerooms and in the manufacturing areas near the employees' work stations. Vari-

ous sized IBM cards, pre-punched with employee payroll numbers, part numbers, lot numbers, and other required data, can be inserted in the transmitters. Variable data (such as quantity) are added by the setting of dials. Only after the correct combination of cards and dials has been entered will the entire message be read and transmitted. The recording equipment at the central location will punch the message in paper tape adding date and time.

Information required to control assembly operations is maintained on RAMAC, a data processing system that has the ability to make computations and update a large electronic memory. It may be thought of as a large automatic filing system with the ability to store, recall and report information at electronic speeds.

"RAMAC" DEFINED

The word "RAMAC" was coined from the phrase "Random Access Method of Accounting and Control." The Random Access feature of RAMAC means that production data may be fed into the machine as it occurs, in random order. The machine will search out all records that the information affects and take the necessary action to record it and report its effect to all concerned. The RAMAC system has storage ability to remember 40 million digits of information. This information is grouped into records of 100 characters each. The information

contained in the records coupled with the ability to revise them quickly to reflect changing conditions, provides the basis for up-to-date analysis and feedback of information collected from the Transacter network.

ASSEMBLY AREA RECORDS

The following records for the assembly area are maintained on RAMAC:

Inventory—One record is established for each part in the Line Flow Inventory. These records serve as an index to all open orders against a given part number.


Open Order Records—One record is established for each Line Flow order. This record is used as the basis for reporting the progress of work against the order, and contains the quantity of parts completed through each stage of assembly throughout the factory.

Operation Master File—A record is maintained in RAMAC representing each manufacturing operation necessary to build a given assembly. This record contains the standard time allowed for the operation as well as the cost center which performs the work. These records are used as the basis for awarding labor performance credit, loading the line, and forecasting future requirements.

At this point, a description of the documents which control assembly is in order. Actual assembly production and the reporting sys-

continued

Figure 3: A "master job card" such as this is prepared for every assembly order.

PROD LOT SERIAL		PROG CODE	ASSEMBLY NUMBER		WORK ORDER NO.		GLA	COST ACCT	B/M NO.	FUNCTION	USE CODE	ASSY'S REQ'D	MAKING
1: 1043			464152		22 36925		1321	1014251	CD	E		108213	
PROD LOT SERIAL		PROG CODE	ASSEMBLY NUMBER		WORK ORDER NO.		GLA	COST ACCT	B/M NO.	FUNCTION	USE CODE	ASSY'S REQ'D	MAKING
1 2 3 4 5 6 7 8 9 10 11 12			13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57		58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80								
													

tem in use will be described in the second part of this article.

Each week, Tabulating prepares control documents for all orders to be pulled from stores in the next 15 days. These cards and requisitions are then delivered to Order Control. The following is a description of the documents in this kit.

Inventory-On-Order Transaction

—This inventory transaction will place assembly requirements "on order" as a result of releasing an assembly order to Stores. The card is received by Order Control with the order kit from Tabulating and retained in the order kit until the order is released. At that time the card is pulled and batched to Tabulating for inclusion in the weekly Assembly Transaction Registers.

inventory to work in progress. It is sent to stores in the assembly order kit.

Stores Locator Card—This card is used in the Transactor to record the receipt of an order in the accumulation area. This is reflected in RAMAC records and therefore in the daily status report. After its transmission via the Transactor, the bin location of the kit is recorded on this card and the card filed in a locator file. When the order is released to the assembly line, this card is again used in the Transactor to transmit the change in status data to RAMAC. The effect in RAMAC of this transaction is to move the released quantity from the accumulation area and locate it "On Line."

Line Flow History Card—This card (Figure 4) is used to record the progress of work on the line. In the case of shippable assemblies, the card also records the receipt of assemblies into Finished Goods Stores and any changes in location on through the shipment. As the production work on assemblies is completed this card is used in conjunction with the Transactor to record completion data in RAMAC. As a result of RAMAC processing, the quantity completed is relocated from "On Line" status to "Quality Control." At this point, labor credit is awarded for production.

The above described documents are prepared in "blank" form prior to actual production assembly work, and are included in the kit of pre-

The form is titled "LINE FLOW HISTORY CARD" on the left side. It contains several sections for data entry:

- Top Section:** Fields for FROM, TO, UNIT, LOT, CHG. PT., and various numbers (43111, 1, 464152, 22, 36925, 001321, 1014251, 02351, 108213).
- Assembly Number:** 464152
- Work Order Number:** 22, 36925, 001321
- GLA:** 1014251, 02351
- FOR PC 55 ORDERS ONLY:** A section with checkboxes for QTY. TO STORES, FROM, and SIGNALS.
- RECORDED:** A section with checkboxes for various status indicators.
- OPS. NUMBER:** 108213
- Bottom Section:** A large area for additional approval stamps, with a note "USE BACK OF CARD FOR ADDITIONAL APPROVAL STAMPS".

Figure 4: A typical "line flow history card" which is used to record the progress of work.

Assembly-On-Order Card—This card (Figure 2) when returned to RAMAC indicates that the order has been released from Order Control to Stores and updates the Assembly Status Report accordingly. This card is kept in the order kit until the order is released, then it is pulled and submitted to RAMAC. This must be done promptly to assure that the Assembly Status Report will reflect the correct situation.

Summary Requisition—This constitutes a list of parts needed to meet the material requirements of a given order. This document serves as the basis for disbursing parts from

Green Identification Tag—This card is also included in the kit and used to identify non-shippable assemblies (generally sub-assemblies which must progress through another assembly department).

Master Job Card—One such card (Figure 3) is prepared for every assembly order. It accompanies the assembly kit to Work-in-Process stores, and is sent to the line with the initial release. These cards are maintained at the Transactor station in the area performing the work until the order is complete. Direct employees use this card to record labor charges through the Transactor system.

pared documents which accompany the original Assembly Order Card. Other record cards may be included in this kit if they apply. Cards for non-shippable assemblies, for etched circuit boards, for shippable modular kits, and for wire preparation, are typical. In all cases, the purpose of these cards is to keep "the finger of control" on every assembly from the time of its justification until it is finished and ready for shipment.

Application of the data processing system to actual production assembly work, and the reporting system used to maintain continuous control will be covered in the second part of this article.

Melting ranges and flow points of brazing alloys

by Karl M. Weigert, Ph.D.
Assistant Professor
Department of Industrial Engineering
Pennsylvania State University

The requirement for silver-copper brazing alloys to "flow well" goes back to ancient times. The Greeks called them "eutectic," meaning "well flowing." Today, this term has a scientific meaning: the eutectic composition of this alloy at 72% silver has the lowest and narrowest melting range. Strangely enough, many low melting compositions require large amounts of the more expensive metals.

During the years between 1930 and 1945, silver brazing alloys were developed for which (by the additions of zinc, tin and cadmium) the melting ranges were lowered and remained narrow enough to avoid segregation.

Binary alloys which consist only of two metals have a melting point below which everything is solid, called "solidus"; the temperature point above which the entire alloy exists only in the liquid stage is called "liquidus."

It was found from experience that certain intermediate temperatures between the solidus and liquidus temperatures give the best brazing results. These arbitrarily chosen temperatures (at which sound and strong joints could be made) were named "flow points" in this country. In Europe, the term "working temperature" was adopted as the temperature at which the brazing alloy would penetrate a joint.

Today, additional requirements have to be considered. Brazing cycles have been shortened, thereby reducing heating costs. Brazing alloys have been developed which form joints sometimes stronger than

the parent metals. One of the best all-around alloys in this respect is the BAG-1 45% silver brazing alloy. It has a melting range so low and narrow (1125-1145°F) that a differentiation between melting, brazing and liquidation becomes strictly academic. Not even today have all the phase transformations and reactions between base metals and filler metals been satisfactorily described. During the relatively short heating and cooling cycle, the complete phase equilibria are not necessarily established. Solid phases can further react with liquid phases in so-called peritectic reactions or through diffusion into the base metal.

Generally speaking, the alpha phase of the pure metals is the most ductile phase; however, the strength is quite low. Beta phases containing up to 50% additions of the copper or silver base brazing alloys are less workable, but form a strong matrix in many commercial brazing alloys. In a non-commercial silver-copper-zinc alloy, the beta phase produces joints stronger than mild steel.

Due to recent improvements in temperature recording techniques, cooling curves can be taken with more accuracy and reproducibility. From the "kinks" in these curves (caused by latent heat of reactions being released), the nature of the solidification mechanism can be revealed. Only a small amount of heat is released at the liquidus temperature; therefore, frequently the true liquidus temperatures have been overlooked, and intermediate lower temperatures named liquidus temperatures instead.

Another method of phase identification is by the use of the microscope, examining ground, polished and etched test specimens. An ex-

perienced metallurgist can readily distinguish the primary, secondary and final solidification.

Another typical example of a silver brazing alloy type is the 15% silver and 5% phosphorus copper base alloy. A ternary eutectic composition with 7.2% phosphorus melts as low as 1185°F, but forms a brittle joint. This temperature—at which a metallic bond between parent and filler metals forms—has been called the "bonding temperature." It is not until the joint is heated to 1300°F that the best brazing temperature is reached. Here all the molten phosphorus-copper reacts with the copper base parent metal, forming a strong ductile bond. (Due to the formation of brittle iron phosphides, this type of filler alloy has little application in the joining of ferrous metals, except for temporary jobs.)

Another example is the nickel base alloys which contain borides and/or silicides. Their melting temperatures are given as 1800°F and higher. This is several hundred degrees below the real liquidus point, at which temperature many of the super alloys would melt. The properties and reactions of the intermediate brazing compositions have not yet been investigated.

Most of the precious metal brazing alloys have the same brazing temperature as often as they are reused; therefore, they are often called "solders." Brazing alloys that contain reactive compounds remelt at higher and higher temperatures. These remelt-temperatures are of great importance for high temperature service components.

Although much information about melting ranges can be obtained from the reading of phase diagrams, most engineers would not be any more interested in the statement of a metallurgist that these alloys form alpha, beta or gamma phases than they would be to hear that he belongs to a Greek letter fraternity. They often overlook that it is the formation of certain phases that governs the proper performance of brazing processes as well as the quality of the joint. One engineer, who was shown a phase diagram and asked if he could read it, replied: "Sure, but there's no one writing on this one." •



Planning assembly stations with modular equipment

by Roy F. Leonard, Industrial Engineer
and Richard E. Deutsch, President
Products for Industry, Inc.

In most plants involved with assembly operations at work benches, there has developed a considerable awareness that a careful study of individual operations can lead to reduced production costs. However, a related study, which offers an equal opportunity for cost reduction, has been largely ignored. It is concerned with the development of the total bench layout within an assigned area, using modular equipment.

Two of the fundamental aims of spatial planning are to minimize the use of valuable floor space and to reduce the handling of materials between stations. To attain these two goals, the planner must take into consideration a large number of factors peculiar to his specific assembly problems. His solution becomes invalid when, as time passes, any of these factors are changed. Thus, a third aim is to provide flexibility so that the layout can be modified with changing conditions or as methods improvements become apparent with experience. Finally, the over-all layout must be consistent with the methods planning for each individual work station.

Some production planners have generally ignored area planning of bench layouts because long ago they decided on adopting a standard work station size and an in-line configuration for the entire plant. This policy, it is argued, permits them to place a bench anywhere in the plant and thus get maximum use of the equipment. Moreover, there is a reluctance to worry about spatial layout planning either be-

cause changes occur so rapidly that today's plans are obsolete tomorrow, or because "we never change" so that the plans created years ago will be appropriate beyond the foreseeable future. Admittedly, such thinking eases the job of the planner, but it results in wasteful assembly techniques.

The various aspects of assembly can be optimized if the complete layout is custom designed for the specific product run within the particular plant situation. Let us, then, examine standardization to determine whether it actually does preclude the possibility of such total layout planning. The policy of standardization need not and should not mean that all benches are identical. A study of properly designed work stations within a plant (often within a single line) would reveal a distribution of desirable sizes and shapes. It would not confirm any one bench as being most efficient throughout. Therefore, standardization must be interpreted in a broader sense, i.e., the use of standard components which can be assembled into a wide variety of work station sizes and configurations. These components can be

used and re-used for work stations throughout the plant but can be put together on the spot to form that layout, designed in advance, to be the most effective for the job at hand.

How about those conflicting arguments about changing conditions? There are few, if any, plants where changes never take place. Three major elements of production planning are continuously subject to variations: the market, which not only determines the volume requirements of an item but also the relative balance between that item and others being manufactured in the same plant; engineering changes; and production methods. Each of these is made up of a large number of factors. A layout which is most carefully designed to fit a given set of conditions becomes something less than the most effective arrangement as those conditions change.

The modification of a layout is impractical if fixed dimension tables are standard. However, the use of standard components as described above produces a relatively simple solution. Just as these components can be used for any type of layout throughout the plant, the layout into

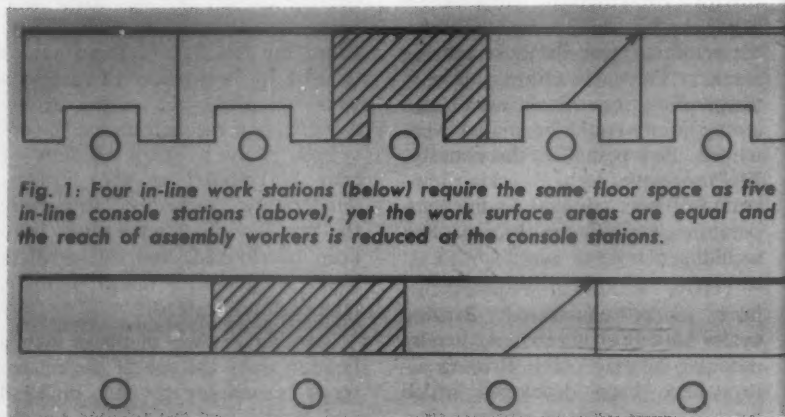


Fig. 1: Four in-line work stations (below) require the same floor space as five in-line console stations (above), yet the work surface areas are equal and the reach of assembly workers is reduced at the console stations.

Fig. 2: Here is an example of an installation of modular work benches. Each operator has 12 sq. ft. of work surface area and 30-in. depth, using only 45 linear inches.



which they are made can be readily altered to fit a new production plan. The concept of standard bench components means inherently that the length or depth of a work station can be modified, the height of an accessory can be changed, a console wing can be added, whole work stations can be added to or removed from the line, and many other changes can be made. Moreover, these modifications need occur only at those points where they are indicated. It is also possible to change the layout at any specific work station to fit changes in the assembly operations performed there. The result is an altered layout which meets a new set of conditions. It is achieved at small cost and without disrupting the entire line.

We have pointed out how the concept of standard components for assembly work stations makes spatial planning a practical undertaking. It allows standardization; at the same time it permits the layout to be designed for the specific job, and provides a means of keeping that layout up to date. Following are two case histories, over-simplified because of space considerations, which illustrate some advantages of over-all layout planning:

CASE "A"

A small electronics firm had considerable success with a new product. Management, in forecasting 1961 volume, realized that assembly facilities would have to be substantially increased.

Problem: The department in question was deemed too small for the

required expansion. The only other available place suitable for production was occupied by the cafeteria, but management was reluctant to move the cafeteria to an unsatisfactory location. All benches in the plant were in modules of 72 x 30 in. (each containing two stations) and arranged in-line. The standard depth was adopted to meet the need of a few scattered operations requiring it.

Diagnosis: None of the operations in the department under consideration needed a work station depth in excess of 18 inches. The excessive depth meant wasted floor space. Bench tops were used to hold pocketbooks, lunch boxes, and street shoes.

Solution: The company ordered standard components to erect in-line work stations which are 36 x 18 in. These are equipped with drawers, shelves, and pocketbook holders.

The narrower work stations proved suitable to the operations and opened up enough floor space (with some rearrangement) to expand the department within the original area. The costly cafeteria relocation was avoided. Production has improved through the use of compact work stations. Better house-keeping was achieved by storing extraneous items away from the bench surfaces which are now reserved for work.

CASE "B"

A manufacturer of data processing equipment was preparing to go into production of a new product under a contract from the government.

Problem: The only available assembly area for the new operation was too small to hold the required number of work stations. All bench operations within the plant were performed at work stations which were 60 x 24 in., arranged in-line.

Diagnosis: Although a work surface area of ten square feet was necessary in the new department, the in-line configuration wasted floor space. It also resulted in an unwieldy arrangement for the assemblers because the 5-ft. span placed items out of easy reach.

Solution: The company used standard components to erect console work stations. Each one is 48 x 24 in. with a wing at either side which is 12 in. wide and projects out one foot. These work stations are thus in the shape of a square U.

The space saved with console stations permitted all the operations to be located within the area. Actually, the configuration permitted 25% more work stations in the space than would have been possible with an in-line arrangement. Moreover, the operators still have ten square feet of work surface but every part of it is within easy reach. (See Figure 1)

Spatial planning solved floor space problems for these companies. The cases are typical because the specifics of each are unique. The concept of standardization of work station components produced solutions which were practical since it makes possible a layout designed to meet a particular situation without necessitating the use of single-purpose equipment. •



A constant sample size inspection and test

This article presents a sampling plan for the layman and assumes no prior knowledge of quality control. It can be used in any type of operation, but is particularly suited to the inspection of fasteners and hardware.

by **Martin W. Sullivan Jr.***
Section Head, Quality Analysis Section
Quality Control Engineering Department
Aero-Weapons Division
Raytheon Company
Andover, Massachusetts

Inspection and test are the usual tools for determining the conformance of an item (end product, assembly, or part) to the drawings and specifications into which design intent is translated.

Wherever it is feasible to risk the probable consequences of undetected defects, inspection and test may be performed on a sampling basis. The risk which can be tolerated determines the acceptable quality level (AQL) or limit (AOQL), and a sampling plan can be developed for inspection and test which will assure that this level or limit is maintained. By defining a sample size to obtain evidence as to the quality of a lot, and by furnishing criteria for evaluating this evidence, a sampling plan provides inspection and test with a means for distinguishing between lots of good and bad quality—thus effecting an acceptable quality level or an average outgoing quality limit.

It is possible, through the introduction of sampling, to reduce the costs of a product which are attributable to inspection and test by up to 80%. The media through which sampling accounts for these savings are (1) a reduction in inspection and test time and/or personnel, (2) an increase in inspection and test efficiency, (3) a reduction in inspection and test equipment, and (4) the elimination of the need

for special inspection and test equipment. There are, at the same time, costs which are peculiar to sampling inspection and test, namely (1) defects which are inherently accepted under a sampling plan—and which appear at a later stage of production or assembly, or during the intended use of the product, (2) shifts in inspection and test workload when lots rejected on the basis of sampling must be 100% screened for defects, (3) errors in the application of the sampling plan, and (4) the administration of the plan.

An effective sampling plan must satisfy two basic requirements: (1) it must provide the quality assurance which is desired; and (2) it must effect savings greater than the costs which it introduces.

The purpose of this article is to present a sampling plan which will maintain the desired quality level and limit for any operation, item, or characteristic and will, at the same time, assure that costs are, or approach, a minimum for sampling inspection and test. The plan is unique in that it utilizes a constant sample size to provide the quality assurance which is desired. In so doing, there is practically no likelihood of error in the application and execution of the plan and, the costs of training, supervision, and administration normally attendant to sampling are reduced to a minimum.

THE BASIC FORMULA

The AOQ is the average outgoing quality, in percent defective,

of the items accepted by Inspection and Test. The AOQL is the limit which the outgoing percent defective will average—regardless of the incoming percent defective—under a given sampling plan. A sampling plan developed to assure an average outgoing quality limit of 1% defective will, conversely, assure that 99% or more of the items accepted by Inspection and Test will conform to drawings and specifications—even though, in actuality, only a small percentage of the items accepted may have been physically inspected or tested.

The plan outlined herein provides the minimum sample size which will, for all lots—regardless of size—assure that the desired AOQL will not be exceeded, and, conversely, that the desired minimum quality yield (MQY) will be maintained.

The AOQL (and, consequently, the MQY) may be established:

1. For an item (end product, assembly, and/or part) to assure that no more than $x\%$ of the outgoing items will be defective for any reason.
2. For an individual characteristic (material, visual, dimensional, or functional property) of an item to assure that no more than $x\%$ of the outgoing items will be defective for this characteristic.
3. For a class (Critical, Major, Minor, etc.) of characteristics to assure that no more than $x\%$ of the outgoing items will be defective

*Since writing this article, Mr. Sullivan has left Raytheon for special project work in Alaska.

procedure

for any characteristic within the class.

The AOQL for any or all of the above applications may be controlled through sample sizes developed from the formula below: (1)

$$n = \frac{wk}{AOQL}, \text{ for a given value of } c$$

where: n is the sample size

c is the acceptance number for the sample, i.e., for a lot to be accepted on the basis of a sample, the sample must contain no more than c defective items.

w and k are constants for a given value of c , and thus the product wk is a constant.

AOQL is the desired average outgoing quality limit for the item, characteristic, or class.

From this formula it is possible to determine the sample size required for any level of quality protection desired and, conversely, to determine for any given sample size, the level of quality protection provided.

If the desired limit for the average outgoing quality of an item, characteristic, or class of characteristics is 2.5% defective, the sample size required, when $c = 0$, would be:

$$n = \frac{wk}{AOQL} = \frac{(1.00)(.368)}{.025} = 15$$

Thus, a sample of 15 items—selected at random from a lot of any size—will maintain an AOQL of 2.5% defective and a corresponding MQY of 97.5% non-defective. The sample size which will maintain an average outgoing quality limit of 4.0% defective is 9 items when the sampling acceptance number is set at zero.

Following are the values of wk , where $n = \frac{wk}{AOQL}$ for given values of c :

c	wk	c	wk
0	0.368	5	3.17
1	0.840	6	3.81
2	1.37	7	4.47
3	1.95	8	5.15
4	2.54	9	5.84

For values above $c = 9$, the value of wk can be closely approximated from the following formula: (2)

$$\log wk = -0.28214 + 1.09537 \log c$$

Formula (1) is applicable to all sampling acceptance numbers, e.g., 6.50

$$n = \frac{wk}{AOQL} \text{ whenever } c \text{ is } 10$$

Under this condition the sample size required to limit the average outgoing quality to 2.5% defective is 260 items—regardless of the size of the parent lots. For an AOQL of 4.0% the required sample size is 163 items.

The advantage in using the larger acceptance numbers for a given AOQL lies in the fact that, as n and c are increased, the capacity of the sample to distinguish between good and poor quality lots is increased. This is shown below:

c	n	Probability of Accepting Lots			AOQL
		2.5% Def.	5% Def.	10% Def.	
0	15	.688	.472	.223	2.5%
1	34	.791	.493	.147	2.5%
2	55	.839	.481	.089	2.5%
3	78	.866	.453	.048	2.5%
4	102	.884	.423	.029	2.5%
5	127	.898	.391	.013	2.5%
10	260	.932	.248	.001	2.5%
25	710	.960	.030	.000	2.5%

It is not unlikely that items and/or characteristics will vary in importance and thus different AOQL's may be desired. In such a case, sample sizes may be assigned in one of two ways: (a) the same acceptance number, c , can be used with a different sample size for each AOQL, or (b) the same sample size, n , can be used with a different acceptance number, for example:

Importance	Desired AOQL	a			b		
		n	c	AOQL	n	c	AOQL
Major	1.0%	37	0	1.0%	35	0	1.1%
Minor	4.0%	9	0	4.1%	35	2	3.9%
Incidental	10.0%	4	0	9.2%	35	5	9.1%

The first approach (a) will require a smaller amount of inspection/test where the quality of the lots submitted for inspection or test is consistently high. The second approach (b) has the advantage noted above for large acceptance numbers and, the use of the same sample for all AOQL's may be simpler to administer.

Formula (1) is readily adaptable to determining the AOQL of an existing or proposed sampling plan. For example, a plan which calls for a sample size of 50 with an acceptance number of 4 provides the following quality assurance:

$$AOQL = \frac{wk}{n} = \frac{2.54}{50} = .051 \text{ for } c = 4$$

Thus, the sampling plan used in any operation, or by any vendor or subcontractor can be immediately evaluated in terms of desired quality protection.

It should be noted at this point that there are three basic assumptions which must be satisfied in order for any sampling inspection or test plan to maintain the intended quality level or limit:

1. The items in the sample are randomly selected.

2. Actual inspection and/or test is accurate.

3. Whenever the acceptance number for the sampling plan is exceeded, the remainder of the items in the lot will be inspected or tested to the extent necessary to remove any items which are defective.

The plan outlined herein will provide the expected quality protection in any application where these as-

sumptions are reasonably satisfied.

OPERATION OF THE PLAN

When a lot is accepted on the basis of evidence obtained from a sample, any defective items in the uninspected or untested portion of the lot will be automatically accepted. In such a case, $OQ = p'$, where OQ is the outgoing quality and p' is the percent defective in the lot. When a lot is rejected on the basis of evidence obtained from a sample, the remaining items in the lot must be screened and all defective items removed and replaced with acceptable items. In this case, $OQ = p' - p' = \text{zero}$. It follows that, for lots of any given percent defective:

time that this percent defective is accepted by Inspection or Test.

In practice, the true AOQ from formula (3) is unknown since the percent defective in accepted lots is unknown and thus $L_a/L_a + L_r$ cannot be related to a given p' . If, however, the expected or most probable value of $L_a/L_a + L_r$ were calculated for a given p' and substituted in formula (3), the expected AOQ could be determined.

Figure 1A below indicates the most probable value of $L_a/L_a + L_r$ for all possible values of p' for the sampling plan $n = 34$, $c = 1$, and Figure 1B indicates the resultant AOQ values—with the highest AOQ being the AOQL for the plan.

$$AOQ = \frac{(p')(L_a) + (p' - p')(L_r)}{L_a + L_r} = p' \times \frac{L_a}{L_a + L_r}$$

where L_a is the number of lots accepted
 L_r is the number of lots rejected

Formula (3) states that the true AOQ is, at any time, equal to the product of the incoming percent defective and the percentage of the

While it is not necessary to develop the curves in Figure 1 in order to apply formula (1), the curves do give a valuable insight

into how a sampling plan based on the formula operates in actual practice. For example:

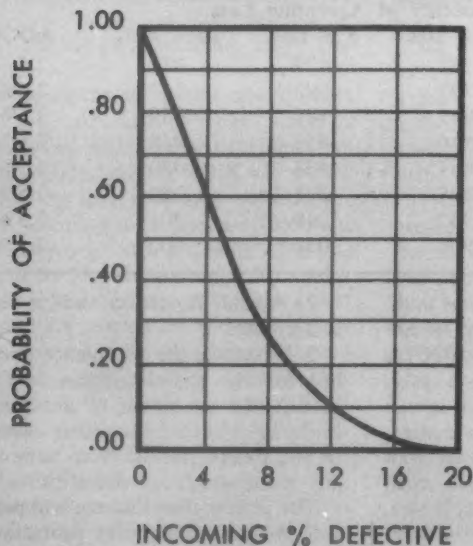
A. Ten (10) lots of 1000 items each are produced and, unknown to Manufacturing or Quality Control, the process (equipment, operators, ambient conditions, handling) is generating defective items at the rate of 60 per lot, or 6% defective.

B. From Figure 1A, the most likely value of $L_a/L_a + L_r$ for lots which are 6% defective is 0.40 when $n = 34$ and $c = 1$, i.e., it is probable that, in 4 of 10 samples selected, Inspection or Test will find one (1) or less defective items. Thus, the 4 lots will be accepted on the basis of the evidence provided by the samples.

C. Conversely, it is likely that 6 of the 10 lots will be rejected by Inspection or Test due to finding 2 or more defective items in the samples selected. These lots will then be screened and all defective items replaced with acceptable items in order to meet production commitments.

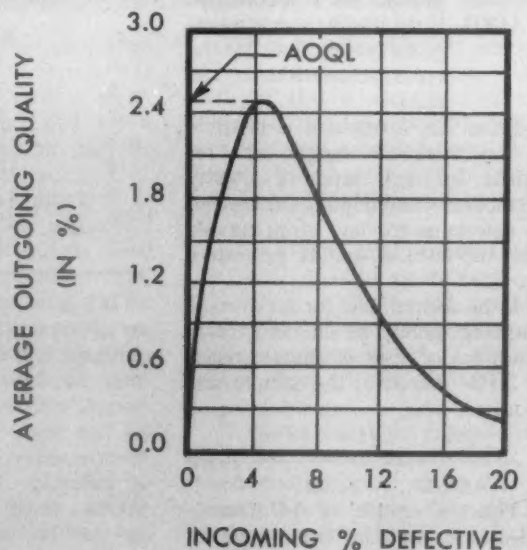
D. Summarizing both B and C: (See top of next page)

FIGURE 1-A



A: OPERATING CHARACTERISTIC CURVE
FOR $n = 34$, $c = 1$

FIGURE 1-B



B: AOQ CURVE
FOR $n = 34$, $c = 1$

Disposition	Total Items Accepted	Total Accepted Items Which are Defective	Outgoing Quality
4 lots accepted	4000	240	6%
6 lots rejected	6000	0	0%
10 lots total	10000	240	2.4%

Figure 1B confirms that, when the incoming quality is 6% defective, the expected average outgoing quality will be 2.4% defective. This figure is within the 2.5% AOQL guaranteed by the plan, and the quality yield of 9760 items is within the 9750 acceptable items assured by the plan.

OC (operating characteristic) and AOQ curves represent the results which are likely to occur when a sampling plan acts upon a lot with a given percent defective. Since it is not reasonable to expect unlikely results to persist, those developing and using sampling plans rely on probable results in their efforts to maintain a given quality level or limit. Whenever the three basic assumptions of sampling (previously noted) are satisfied, it is inevitable that, over a period of time, the

conditions described in the OC and AOQ curves will prevail. Thus, it can reasonably be expected that the average outgoing quality of items accepted by Inspection or Test will not exceed the AOQL guaranteed by the plan and that the minimum quality yield assured by the plan will be maintained.

SUMMARY

As noted previously, the AOQL may be applied to an individual characteristic, to a class of characteristics, or to an item (all characteristics collectively).

When the AOQL is applied to an individual characteristic (AOQL_i), the acceptance number is applicable to this characteristic only. Thus, when the number of defective items in the sample is within the acceptance number, the

lot is accepted for the individual characteristic only. When the number of defective items in the sample exceeds the acceptance number the lot is rejected for the individual characteristic, and the remaining items in the lot will be screened for defects in this characteristic only. This assures that the individual characteristic will be defective on no more than AOQL of the items accepted.

When the AOQL is applied to a class of characteristics within an item (AOQL_c) the acceptance number is applicable to the included characteristics collectively. Thus, when the number of defective items in the sample is within the acceptance number, the lot is accepted for all characteristics within the class. When the number of defective items in the sample exceeds the acceptance number the lot is rejected for all characteristics within the class, and the remaining items in the lot will be screened for defects in all characteristics within the class. This assures reason that no more than AOQL of the accepted items will have a defect in this class.

continued

FIGURE 2

INSPECTION PROCEDURE

PART NAME: Manifold

PART NO. 080923 Rev. C

CHARACTERISTIC

GAGE/EQUIPMENT

Class: Major

$n = 35, c = 0$

AOQL: 1%

1. 1.0455 - 1.0465 Bore Dia.

Air Spindle

#31160-0

Min. Master

31160-1

Max. Master

31160-2

2. Location of 1.0455 Dia. Bore
1.926 - 1.948 x 2.770 - 2.792
from Center

Hole Location Gage

32760

3. 6 (.138) - 32NC - 3B Tapped Hole

Thread Plug Gage Go

32460-0

No Go

32460-1

Class: Minor

$n = 21, c = 1$

AOQL: 4%

4. Depth of 1.0455 Bore Dia.
.499 - .529 from Surface -B-

Flush Pin Gage

#41060

5. 63/ Finish, Surface -B-

Surface Finish Scale

When the AOQL is applied to an item (AOQL_i) the acceptance number is applicable to all characteristics of the item collectively. Thus, when the number of defective items in the sample is within the acceptance number, the lot is accepted for all characteristics of the item. When the number of defective items in the sample exceeds the acceptance number the lot is rejected for all characteristics, and the remaining items in the lot must be screened for defects in all characteristics of the item. This assures that no more than AOQL of the items will be defective for any reason.

The relationship of the three applications of the AOQL can be expressed as follows: (4)

$$AOQL_i \approx \sum AOQL_c \approx \sum AOQL_s$$

In Fig. 2 (page 43), an AOQL is applied to each class of characteristics within the item. Thus, no more than 1% of the items accepted will have a defect which is Major, and no more than 4% will have a defect which is Minor. Finally, from formula (4), no more than 5% of the accepted items will have any defects.

In the absence of an Inspection or Test Procedure (as in Fig. 2), the classification of each characteristic may be indicated by a symbol on the product drawing or specification—each symbol carrying with it a constant size sampling plan, e.g.:

Symbol	n	c	Class	AOQL
	35	0	Major	1%
	21	1	Minor	4%
	8	1	Incidental	10%

The plan outlined herein is applicable in all cases where it is feasible to accept a calculated risk that some percentage, however small, of the items accepted by Inspection or Test will be defective. It is applicable to all internal manufacturing and assembly operations and can be used at Receiving Inspection under the following conditions:

1. A satisfactory agreement has been reached with vendors to the effect that all lots rejected by the

contractor will be screened by the vendors, or

2. Lots which are rejected by Receiving Inspection will be screened by the contractor (presumably at the vendor's expense).

These conditions are not peculiar to this plan but hold, as well, for all sampling plans of which the intent is to maintain a given quality level or limit.

This plan for constant sample size inspection and test is not limited by the complexity of the product and, it is adaptable to large or small manufacturing, assembly, inspection, and test operations. It has proved to be very effective in actual practice, both as a control of outgoing quality and as a factor in reducing inspection and test time, administration, and errors of sampling. Consequently, the costs of maintaining a quality product have been greatly reduced.

OBSERVATIONS

The only reason for conducting inspection or test on a sampling basis is to reduce the cost of these functions. Whether the sampling plan is developed on a statistical basis, or on a logical, non-statistical basis is unimportant so long as the plan provides the quality assurance which is desired.

It is reasonable to expect that items to be produced in large quantities will be generated on proven, repeatable, automatic equip-

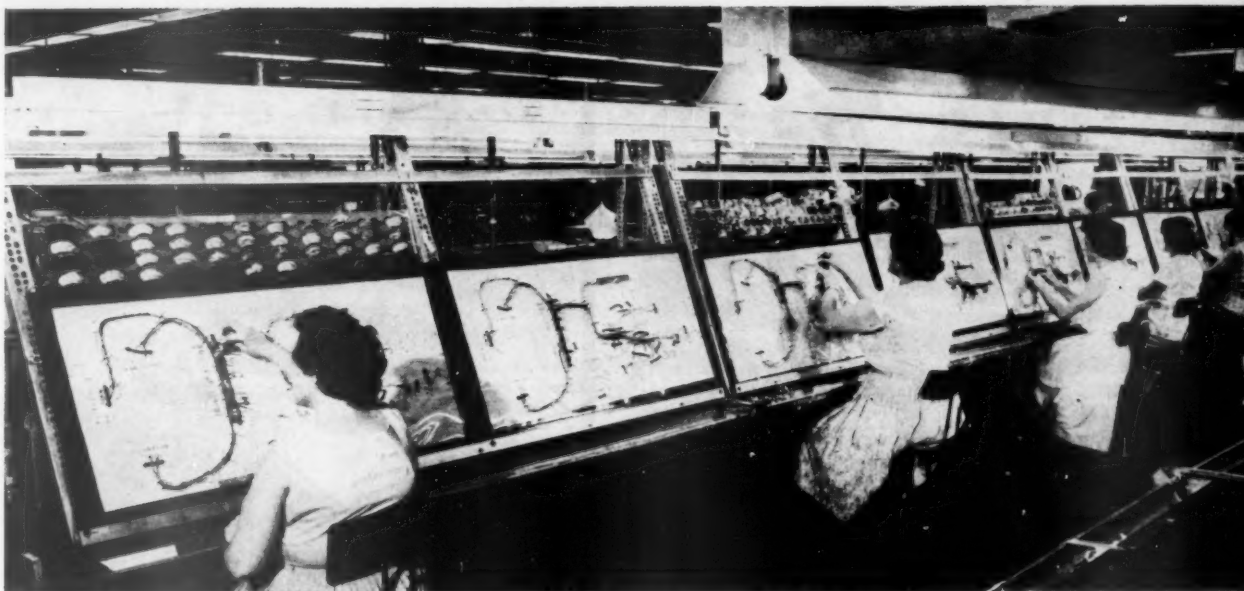
ment. This is particularly true of fasteners and related items such as nuts, screws, bolts, washers, inserts, gaskets, pins, rings, terminals, rivets, eyelets, etc. In such cases, it is probable that all items in a lot will conform to drawings or, all items will be non-conforming for one or more dimensions. Where the quality history for the item confirms the above conditions, two substantial benefits can accrue:

1. The sample size derived from formula (1) can arbitrarily be reduced by 50 to 75% without appreciably increasing the risk that the AOQL will be exceeded, and

2. The need for 100% screening of rejected lots can be eliminated. In rejected lots it is likely that all sample items will be defective for the same dimension(s) and, most probably, all remaining items in the lot will be similarly defective. Thus, screening becomes unnecessary, and the disposition of the lot becomes a Materials Review or Salvage Board decision. Thus, one of the most costly inspection operations—the screening of large lots rejected on the basis of sampling—is eliminated.

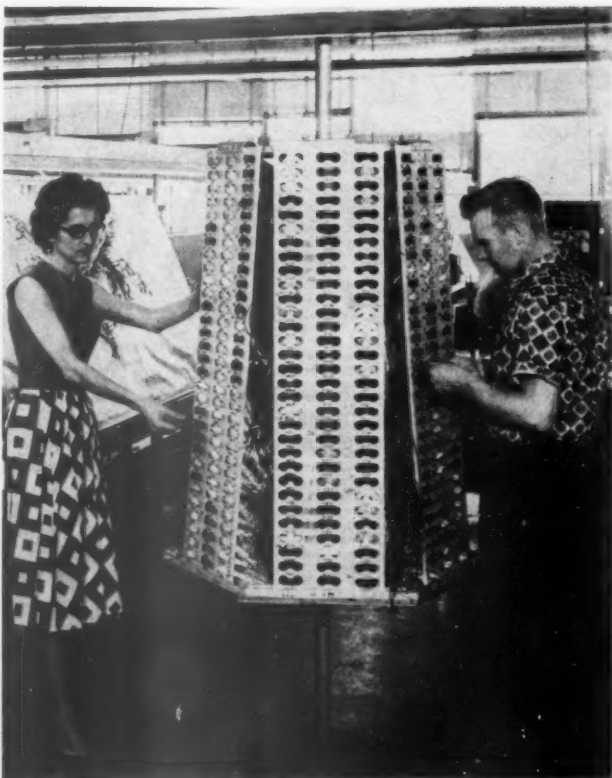
It should be emphasized that the above steps should not be taken until such time as the process proves to be repeatable and the quality history (obtained from a plan such as that outlined in this article) verifies that such conditions do, in fact, exist. •





Erected at cost of \$500 for labor and material, this A-frame assembly line resulted in a 35% saving in production costs.

An assembly line for wire harness!



This lazy susan wire holder located near assembly line takes up 75% less floor space than the 4x8-ft. bench previously used.

An innovation in the cable section of their assembly department has resulted in a direct labor saving of 35% in the production of wire harnesses at the Pleasantville (N.Y.) Instrument Corporation, manufacturing subsidiary of the GPL Division of General Precision, Inc. This innovation put their harness assembly on a production-line basis, an industry first, according to J. F. Price, vice president of operations.

All this was achieved through the installation of an A-frame on 64 x 2 feet of bench area. This framework can be adjusted to handle harness boards of varying sizes, up to 4 x 8 feet. In addition, harness assembly can be performed on either side of the A-frame.

Workers along this 64-foot framework build up the wire harness on pattern boards covered with a transparent material, through which nails protrude. Precut wires are strung around the nails and fastened with spiral springs. The workers follow a pattern established by numbering pegs on the boards and numbering the precut wires in the wire holders above the pattern boards, or in a "lazy susan" holder.

This latter holder is another innovation which saves 75% of previously required floor space. The device occupies about 9 square feet between two harness assemblers, who draw wires from one rack. Each of the six sections in the lazy susan can be removed for loading precut wires. Previously, the operations required an 8-foot bench or 32 square feet of floor space. Steps required by workers have been greatly reduced. •

how to build a house in a day...



5



1 Floor panels are locked to joists laid on permafrost ground.

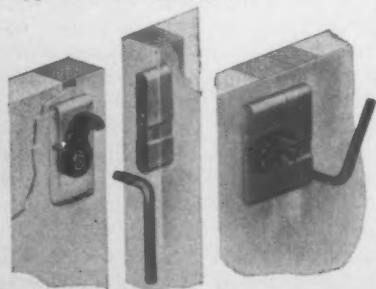
2 Doorway is first wall panel to go up. It locks to floor.

3 Walls and partitions lock to floor and to each other.

4 Roof panels go on last. This takes about three hours.

5 Complete in 7 hours! Floor, walls, roof panels—It's all done with Simmons Dual-Lock fasteners.

Standard Dual-Lock withstands 2500-lb. tension; may be modified for high-load applications to 4500 lbs.



■ This house is put up in a day — and can be taken down in half a day!

■ Key to quick assembly-disassembly is the Simmons Dual-Lock.

Dual-Lock is a high-load, positive-locking structural fastener perfectly adapted to panel fastening of demountable shelters, shipping containers, covers, cowlings... and to all butt-joint fastening jobs. It can be recess-mounted as in the application pictured, or surface-mounted on sheets or panels. Locks with heavy closing pressure, with very light pressure required on the key.

Arctic Units, Ltd., Toronto, Canada, is putting up 90 "Eskimo Houses" on the DEW Line. Panels, including roof, are plywood-covered plastic foam designed for insulation against Arctic cold.

WRITE FOR CATALOG 760. Complete details of Dual-Lock and other dependable quick-operating Simmons Fasteners with unlimited money-saving applications.

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The effect of zinc plating on threaded fasteners



by **W. M. Henneman**
Executive Engineer
Shakeproof Division
Illinois Tool Works

Torque applied to a nut must overcome the friction of the nut face (approximately 50%), the friction of the threads (approximately 40%) leaving approximately only 10% for use in creating tension in a threaded fastener. These values apply to unplated bolts. Zinc plated parts—because of the higher coefficient of friction of zinc—should consume higher percentages of torque to overcome friction, leaving less torsional force for creating the tension. To investigate this theory, a series of tests were made on a machine developed by our company for the simultaneous measurement of torque and tension.

Both 1/4-20 x 1-3/4 hex head screws and 1/4-20 standard hex nuts were used in these tests. The nuts were tightened against 1" x 1" x .045 steel plates with .260 holes supported so that the distance from screw head to face of nut was 1 3/8". Parts with and without zinc plating were tested.

Preliminary tension tests were made of plated and unplated bolts with the result that both types showed 2300 lbs. tensile strength (72,500 psi) proving that the plating had no effect on the tensile strength of the bolts.

As the nut is run down, tension is created in the screw. At the same time, the friction of the threads causes a twisting in the screw which is resisted by the rigidity of the screw. The screw is therefore subjected to both tensional and torsional forces. The test machine measures the resulting tensile force in the screw under these conditions. Since this is not simple tension, the modi-

fied tensile values, for the sake of brevity, will be referred to as "twist-tension."

The bolts were tested to their elastic limits, and the values recorded are the maximum torque applied to start stretching the bolt and the resulting twist-tension at this point.

PLAIN FINISH PARTS

The first five bolts tested were unplated but with a trace of oil on them so they would not be bone dry. The procedure was to apply torque until stretching started, reverse the machine to zero torque and tension, and immediately repeat this twice. The first and second repeat tests were to see if different results were found on re-use. Values were taken from graphs produced by the machine.

Analyzing (1A) we find that 91 lb.-in. torque will cause the bolt to stretch at 2170 lbs. twist-tension, which closely approaches 2300 lbs. as found in pure tension. Assuming that 65% of the tensile strength of

a bolt is a safe value for a bolted joint, we have selected 1500 lbs. as a recommended value and determined that 64 lb.-in. torque will produce this tension.

ZINC-PLATED PARTS

A number of the same parts were given various thicknesses of electroplated zinc. From these were selected four of each part (screw, nut and plate) which had a light coating of only .00005 as checked by the Dermatron non-destructive coating thickness tester. Tests were made on the sides of the nuts, on the sides of the hex heads, and on the face of the plates. These were tested in the same way as the plain finish parts with the following results:

Comparing (1A) and (2A) we find that the plated parts required 110 lb.-in. torque to produce failure against 91 lb.-in. for the plain parts. The greatest difference was in the ultimate twist-tension which could be obtained to stretch the bolt. Plated parts failed at only 1406 lbs. as compared with 2107 lbs. on un-

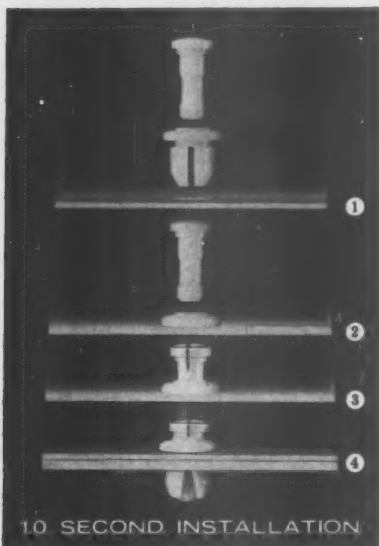
continued

Plain Finish Tests						
Tests	No.	Ultimate Torque (lb.-in.)		Ultimate Twist-Tension (lbs.)		Torque-1500 Lbs. Twist-Tension (lb.-in.)
		Avg.	Range	Avg.	Range	Avg. Range
(1A)	5	91	(90-97)	2170	(2000-2225)	64 (62-69)
(1B)	5	91	(88-96)	2195	(2050-2250)	59 (53-60)
(1C)	5	91	(87-97)	2200	(2050-2250)	58 (50-60)

Tests on .00005" Zinc Plated Parts						
Tests	No.	Ultimate Torque (lb.-in.)		Ultimate Twist-Tension (lbs.)		Twist-Tension at 65 Lb. In. Torque (lb.-in.)
		Avg.	Range	Avg.	Range	Avg. Range
(2A)	4	110	(108-112)	1406	(1250-1625)	920 (825-1050)
(2B)	4	112	(103-118)	1042	(950-1200)	525 (450- 625)
(2C)	4	112	(102-125)	905	(870- 975)	438 (400- 475)

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- ③ PUSH IN PLUNGER - CAPTIVATED!
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Perhaps one of these uses reminds you of an application that will help you cut costs.

Various head configurations are available; the easy-grip, the mini-grip and the tamper-proof shown above.

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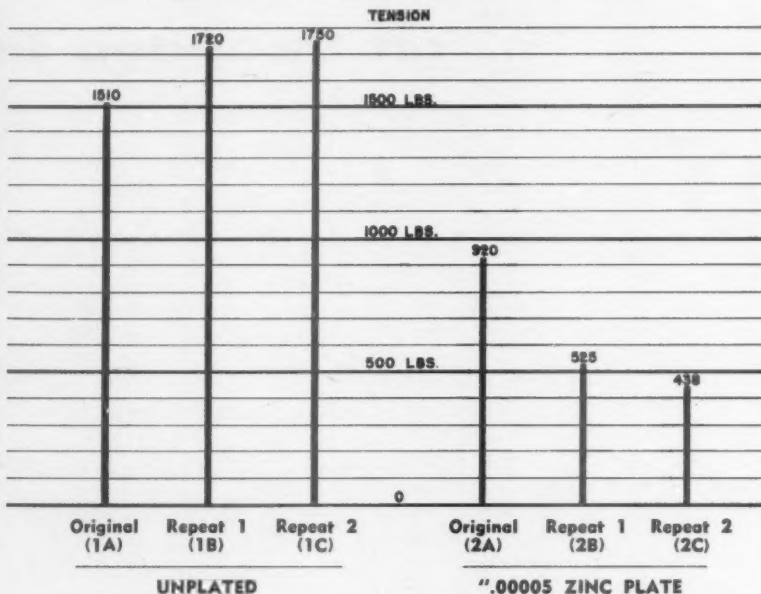
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plated parts, about two-thirds the value. It can be seen that a desired tensile value of 1500 lbs. could not be produced in the bolt by tightening the nut because the bolt would fail before this tension was attained.

of torque to tension on threaded fasteners. It appears that it is impossible to tighten the bolt to the tension where the bolt is supposed to safely carry the load (1500 lbs.) because the twist on the bolt causes

Tension Produced in 1/4-20 Bolt at 65 Lb.-In. Torque



To show the difference between twist-tension and tension, the machine was stopped at ultimate, where the bolt began to stretch, and the torque force was removed by reversing the machine a slight amount. The bolt was then under 1400 lbs. tension. The machine is so constructed that by means of a wedge, the tension can be increased independent of the torque. The tension in the bolt was then increased to about 2300 lbs. before stretching started again.

The first repeat tests (2B) showed a reduction of ultimate twist tension from 1406 lbs. to 1042 lbs. The second repeat tests (2C) showed a further reduction to 905 lbs., 500 lbs. less than the original tests (2A) and 1300 lbs. less than that of the unplated part (1C).

If a specified tightening torque of 65 lb.-in. were applied to the plated and unplated parts, the resulting tensions in the bolts would be as shown on the chart above.

These tests indicate that zinc plating, even so small as .00005 inches thick (flash plating) has a very great influence on the relation

of torque to tension on threaded fasteners. It appears that it is impossible to tighten the bolt to the tension where the bolt is supposed to safely carry the load (1500 lbs.) because the twist on the bolt causes

it to stretch before this point is reached. Because of the difficulty in determining the tension in an applied bolt, this effect is not readily apparent and one begins to wonder if zinc plated threaded fasteners are as efficient a method of fastening as one would normally expect. High driving torques for zinc plated fasteners give the illusion that high tensions naturally result.



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from .040" and up in popular shaft increments.



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—for axial installation

Specifically designed for NAS 670 standard grooves. Termed the CS Series, stocked in all popular sizes.



INTERNAL TYPE

—for axial installation

Specifically designed for NAS 669 standard grooves. Termed the CR Series, stocked in all popular sizes.



EXTERNAL TYPE

—for radial installation

Provides unusually large shoulder for small shafts—termed the CE Series, stocked in all popular sizes.



EXTERNAL TYPE—

for radial installations involving high thrust. Provides double the thrust capacity of standard "E" rings (CE) with comparable large shoulder.

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—engineered to your requirements

Ramsey engineers will be glad to work with you on the design of special ring shapes to meet your individual needs.



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—for rapid assembly

All CE Series rings from 1/4" to 1/2" can be supplied stacked on hardened rods for assembly line operations.



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—heavier or lighter than standard

Rings heavier or lighter than standard thicknesses can generally be supplied on special order.



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A wide variety of special materials, finishes and platings are available to meet practically any requirement. Ramsey engineers will help you select the type best suited to your needs.

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Ramsey's special finish technique eliminates burrs and scale for maximum performance. Precision design eliminates bevelling or waviness in the ring. Tapered section design permits maximum conformability. Ring grip is not adversely affected by expansion or contraction within the allowable limits. Together with the complete selection of materials and finishes, Circolox gives you unlimited opportunities to cut costs and improve product design and performance. Circolox rings meet all industry and government standards.

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This exclusive full round retaining ring is mass produced on high speed rollers in a practically unlimited range of sizes. Prototypes can be made without need for tooling. Sizes made from .375" up to 48" and in many varieties, such as single turn, multi-turn, self locking, resilient take-up, etc. Check these outstanding features:

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- Two-turn, full-circle design eliminates gaps.
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GASKET BONDING BY INDUCTION HEATING

One of the new applications of induction heating is for bonding gaskets to metal. An example of this is found in the automotive industry where one company is bonding the gasket to the valve push-rod cover. This new technique, developed by Inducting Heating Corp., produces 250 assemblies per hour.

Here are the particulars. The gasket is made from cork and rubber .170" thick with a .005" coating of neoprene. The side to be bonded to the metal cover is covered with an R.585T adhesive which forms a strong bond when heated to about 280°F.

The cover is a medium-gauge steel, slightly convex, ribbed, and with a 1/4" x 1/4" channel formed on the edge which receives the gasket. The over-all size of the cover is 2 3/4" x 4 7/8".

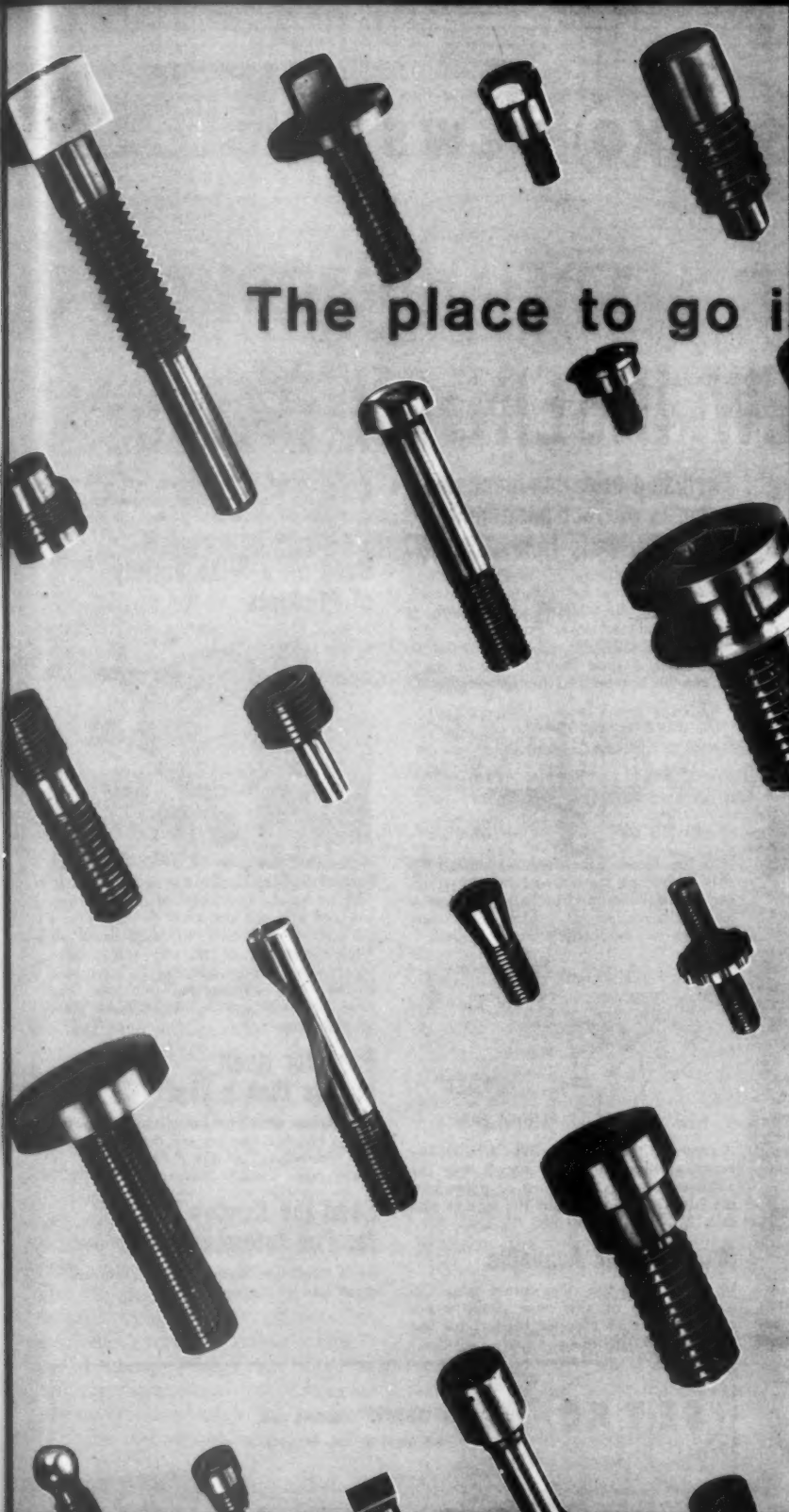
Operation of the bonding fixture involves four steps. First the operator locates the gasket in the fixture with the adhesive-coated side face up. Next he locates the push-rod cover over the line-up pins and gasket. The fixture is indexed, pressure is applied, and the whole unit heats for five seconds. (The pressure pad holds for four seconds and then releases.) Then the drum indexes and the completed assembly is unloaded through a chute. During the processing period, the operator has loaded the next assembly which indexes into position upon depressing double-palm buttons.



With this induction heating unit, 250 assemblies can be bonded per hour.

Assembly & Fastener Engineering

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And our service on standard alloy steel screws, like our service on specials, is geared to provide the same prompt action. Call Mac-it Engineering Service or contact your nearby Mac-it distributor for all your needs in alloy steel screws.

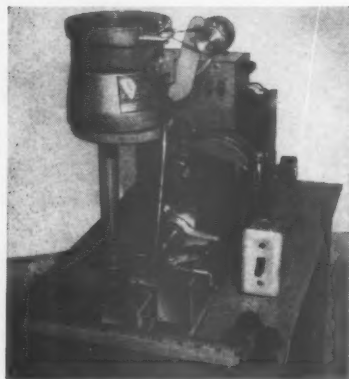
Standard Mac-it Screws are available in many types.



MAC-IT PARTS COMPANY
LANCASTER • PENNSYLVANIA

NEW HOPPER FEEDER QUADRUPLIES SET SCREW INSERTION RATES

Labor costs cut by 75%



Changeover from manual to automatic insertion of set screws is now easier and more profitable than ever. More profitable because this new, compact, Setko Hopper Feeder requires less space—and embodies advancements and refinements in design to make for greater operating efficiencies. It is now possible to actually quadruple insertion rates over the hand method, while cutting labor costs by 75%.

Operation of the machine is less complicated than the hand method. All the operator has to do is feed the workpiece to the receiving pad and the machine automatically drives the screw to a predetermined depth. Every screw is uniformly inserted.

Additional savings result from a reduction in rejects and floor loss. Users report "rejects have been cut to almost zero and floor loss has been eliminated!"

More than fifteen years of experience in the design, engineering and manufacture of Hopper Feeders is behind the cost-cutting, production-increasing performance of this new model.

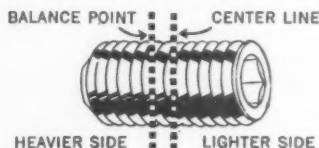
Feeds any type of headless set screw and with any point style



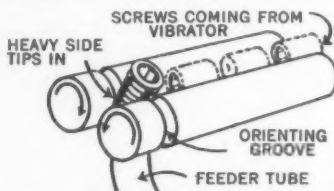
Hex Socket, Fluted Socket, Slotted or Slabbed heads and with any type point, can all be oriented and fed with equal efficiency. Even "specials" can be oriented in most cases.

Exclusive orienting mechanism assures perfect positioning of screw every time

It's really a matter of balance... Every type of set screw has a point of balance. Because of the manufacturing methods used it is almost never exact center. This means that from the center of the screw, one end is a little heavier. The object is to get the heavier end to tip consistently



into the feeder tube. Setko accomplishes this by feeding the screws from the vibrator to the orienting mechanism where it is literally wafted on a cushion of friction between two oppositely driven rollers.



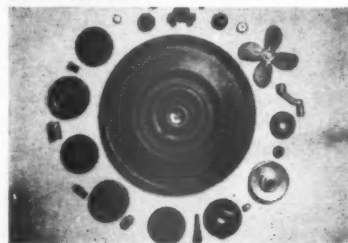
A groove in each roller acts as a balancing point so that no matter which way the screw approaches, head first or point first, the heavier end tips into the groove and falls into the feeder tube.

Many Models Available

In addition to the air-operated table top model shown on this page, Setko has a complete line of Hopper Feeders for use

with vertical drill presses, etc. Various type driving and feeding mechanisms are available to assure the right combination for your operation.

Used on a Wide Variety of Products



Automated insertion of set screws is performed on these and many more products. The workpiece is simply fed to the receiving pad and the set screw is driven to a predetermined depth. In most cases the final tightening of the set screw takes place when the component is assembled to the main product. In some cases, the final inserting and tightening take place at one time.

Pays for itself in less than a year

Companies who have bought and are using Setko Hopper Feeders say that, "they pay for themselves in less than a year." In many cases, "much less than a year."

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MANUFACTURER'S

REFERENCE FILE-17

Designing for Tension Control

Presenting several important torque-tension considerations and the relationship of the torque-tension impact wrench.

by **Roger I. Swanson**
Advanced Engineering
Gardner-Denver Company

A straight line is the shortest distance between two points; also, specifying the clamping force required for a fastener is the direct approach every designer would like to use. However, today's methods are relying upon the torque-tension method, in which torque is the indication of a bolt's tension. Many advances have been made in the past few years to prove tension and to obtain consistent tension. And today there are several methods of obtaining bolt tension.

It is interesting to recall that not too many years ago, an experienced worker would put a wrench on a fastener and "bring it up tight and give it an extra turn." This was satisfactory with skilled workers, but with the advent of power tools to speed assembly work, the "feel" of the operator was lost. Special wrenches were developed to prove that the torque obtained was satisfactory.

Torque may vary considerably for a desired tension. When galling and seizing start, torque may increase two to ten times, or even more, under adverse conditions. The torque-tension relationship can be improved. And the sooner that

designers, fastener manufacturers, power tool builders, and assembly fabricators seriously work toward that end, the faster we can reduce costs and increase reliability.

RELIABILITY

Why the concern for proper bolt tension? Product reliability is the first consideration in any design. Rolls Royce automobiles are an example of this; all critical fasteners in these cars are tightened until the desired tension (stretch) is obtained. If the fasteners are stressed or preloaded above the maximum fluctuating load, the fasteners will not loosen or fail from fatigue.

To obtain a reliable product, the design must be correct. Too often, not enough engineering attention is given to the fasteners, resulting in failures of undetected sources. A good start is to remember the adage that "a chain is no stronger than its weakest link." Therefore, the bolt, nut and assembly must be capable of obtaining the desired prestressed loading. Many pages could be written covering the reasons why torque-tension relationships will vary. The two most important considerations are:

1. The bolt and nut or screw, plus the tapped hole, must be designed materially and physically so that the bolt or screw will fail only by fracture of the thread or shank, and

not by stripping or shearing of the threads.

2. All members in compression must be stressed within their respective elastic limits. Once a member is stressed beyond the yield point, extra energy is required to cold-work the metal to a higher stress level that can support the greater load.

Consider the case of the designer who was trying to obtain the maximum clamping force on a Grade 8 heat-treated bolt. In preliminary tests, a few such bolts reached the minimum proof loading, and a majority would obtain 90% of the load. With an additional few degrees of tightening, they would lose 25-50% of the clamping force because the threads of the softer nut would strip and shear. A heat-treated nut capable of causing the bolt to yield should have been used.

Similarly, consider a heat-treated fastener used in an aluminum block with insufficient thread engagement in the tapped holes. There should be enough threads engaged to cause the bolt to yield. If this is not happening, a lower tensile bolt or screw should be used. The stripping load of the tapped hole must be sufficient to hold the assembly.

A problem encountered recently concerned several 7/8-14 socket head cap screws which were loosening or failing on a hydraulic machine. The

continued

loading on each screw was only 10,000 pounds; the average yield for each screw was around 58,000 pounds. Yet, no matter how much they were tightened, the fasteners would loosen after a few thousand cycles of the machine. The problem was that the material under the screw heads was soft and yielding. A larger bearing area was required, and the screws tightened above the maximum load. It can be noted that smaller screws properly tightened could have done the job.

Recently, one manufacturer changed from a Grade 2 to a Grade 8 bolt with the expectation of eliminating a fastener failure problem. The higher tensile bolt also failed. Upon investigation, it was found that the bushing used was collapsing at approximately 3,000 pounds. Therefore, the Grade 8, $\frac{3}{8}$ -16 fastener could never reach its designed capacity (approximately 11,000 pounds yield). Hardening the bushing to higher yield, and using a Grade 5 bolt, would fulfill the design requirements and still retain interchangeability and the lowest in-place cost.

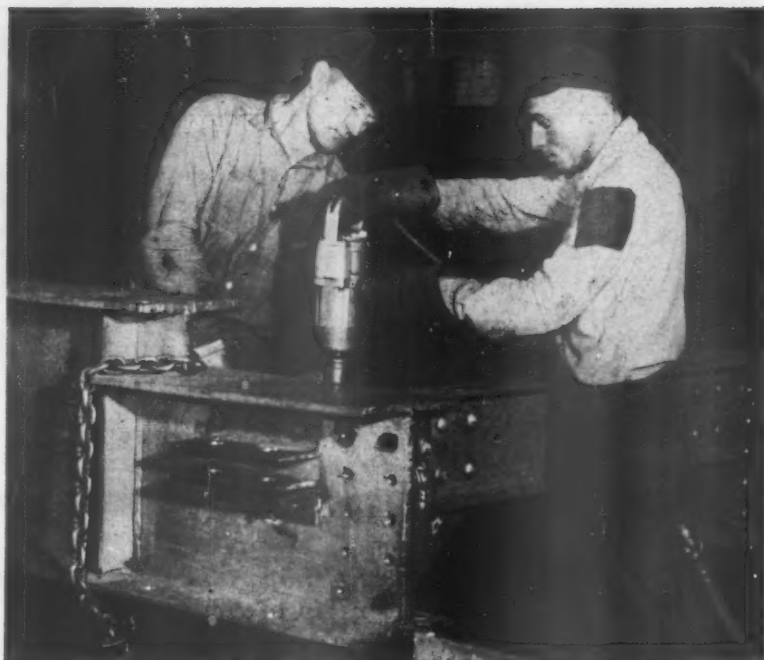
TORQUE-TENSION

Under ideal design conditions, a given torque will produce a consistent bolt tension; however, normal production variables will prevent even the most accurate torque wrenches from obtaining the desired tension. Consideration must also be given to the differences in fasteners. It is possible to obtain a well-designed plated and waxed nut that will produce a minimum proof load on a $\frac{3}{4}$ -10, Grade 5 bolt with 100 ft-lb torque. On the other hand, a standard fastener may gall or strip threads at 600 ft-lbs, and never obtain the minimum proof loading.

TENSION CONTROL WRENCH

The fact that similar fasteners will vary in torque-tension relations is of major concern to the user. If we have a properly designed fastener system and we do not have welding or galling, how can we overcome the variations from fastener to fastener? One solution is a tension-control wrench. The means of control is energy control. The maximum energy put into a system cannot exceed the resultant energy.

With impact energy, the angular momentum equals the sum of the



Tension-control wrenches had their first applications in the steel construction industry. Smaller models are designed for use along assembly lines.

angular momenta of all the parts in a system times the angular velocity. (H_o = summation of I_oW = Constant)

The bolt and nut reaction determine the time rate of deceleration, and, therefore, the resultant energy output. For example, if $H_o = I_oW$, one ft-lb sec. were decelerated in:

1	Sec. Torque	Output = 1	ft-lb
.1	"	"	10 "
.01	"	"	100 "
.001	"	"	1000 "

Therefore, the maximum tension is obtained when the forces are balanced. By changing the angular velocity, the input can be adjusted to the required amount. It is important that each blow of the wrench be consistent regardless of air pressure or run-down conditions. When the energies are balanced, the fastener will stop turning; loss of rotation is the signal.

If we are controlling torque, how can we hope to obtain a consistent bolt tension. The answer is that a consistent high energy impact has the tendency to reduce frictional variations.

WEDGE EFFECT

If we consider the thread helix as a wedge, the impact is lifting the bolt with a force approximately 30 times the torsional component. The impact energy will do three things:

1. There is a sudden stretch on the bolt, reducing the clamped force and frictional resistance to turning.

2. Under a high energy blow, the surfaces are vibrated, producing a molecular change which reduces friction in the same manner as static and sliding friction vary.

3. With many repeated blows of the same force, the average torque will result in a more consistent tension than a single torque application.

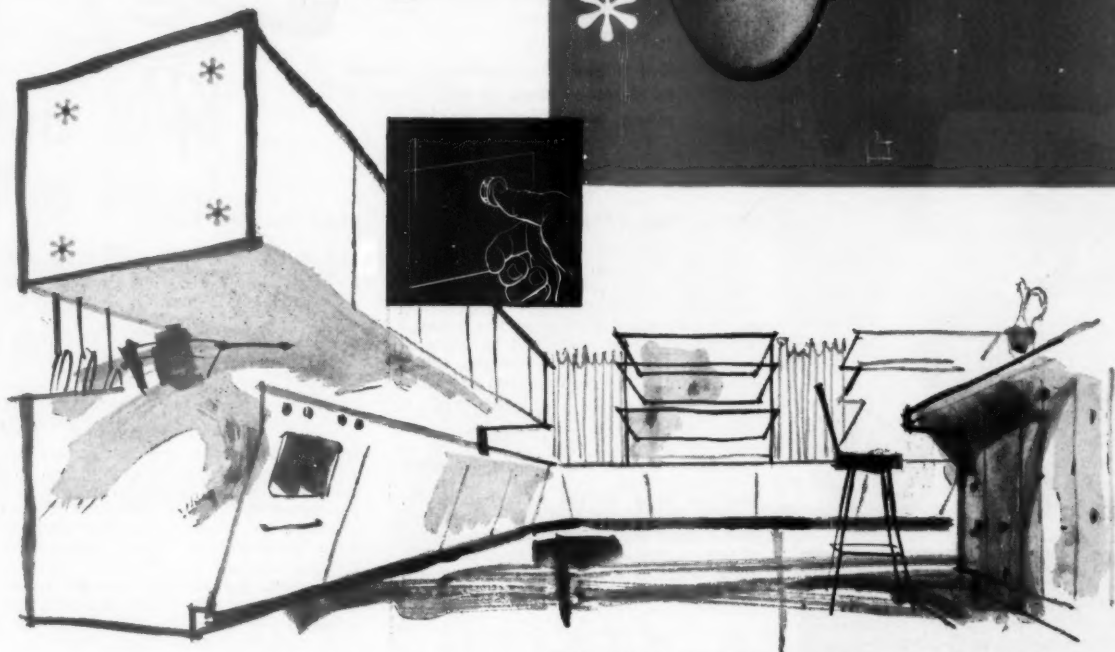
A similar example of energy balance is that of a pile driver. A weight is lifted to a certain height and dropped on a wood piling. With the first few blows the penetration is greatest. However, after the friction and shearing of the lower strata become greater, the penetration becomes less and less until the energies become balanced. The construction engineer knows that the pile will support a certain load at which point the driver is stopped.

In conclusion, we have found better results under adverse production conditions with our new tension-control wrench than with our former standard impacts. With what we have learned to date, we can help implement further advances in proper fastening techniques for better products of tomorrow. •

Good looks count

... and you can count on improved product appearance with

Plasti-Plugs®



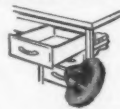
Plug production holes



Ventilation plugs



Cover access holes



Silent drawer glides

Metal kitchen cabinets with unsightly production holes showing? Not if Fastex Plasti-Plugs (one piece, self-retaining hole plugs) are used! Snapping-in with a light touch of the finger, Plasti-Plugs are available in 45 standard sizes, in colors to match every product. Low in cost to buy and apply, Plasti-Plugs do double duty too—can be used for dust protection, friction glides and as replaceable plugs. Special moisture-sealing plugs may also be had. Made of polystyrene, nylon or vinyl, they're non-corrosive, always good-looking.



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45 standard sizes listed... tells how easily you can "snap in" Plasti-Plugs by Fastex.



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Self-locking, wear-resistant, machined, stainless steel threaded inserts for use in aluminum and brass. Easily applied, their dependable grip in the parent metal as well as their permanent self-locking ability make them ideal for a diversity of critical uses. The complete line includes one basic type in four sizes. Each of the four sizes are available for insertion into any of five metal thicknesses. All National Radio Company self-locking captive nuts are made to conform with the following specifications:

Material: Stainless steel Class 303 per FED QQ-S-753b.

Finish: Passivated per MIL-P-12011.

Threads: Size 4, 6, and 8: NC-2B.

Size 10: NF-2B.

National Radio Company also manufactures other captive nuts and studs including the line of exclusive "Flush Mount" types. Available in five sizes for use in metal thickness from .316" up, this type of captive nut fits flush on both sides of aluminum or brass sheet to provide strong permanent tapped holes.

National Radio Company's engineering staff will be glad to discuss your applications and possible variations to best meet your requirements.

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**AS
RUDY
SEES
IT**



Got a question, challenge, puzzle to share or story to tell? Shoot it along, we'd like to meet you.



THOSE TIME PAYMENT BLUES

It is reported that next year, American manufacturers plan to get 12% of their sales in products that did not even exist four years ago. Development at that rate would indicate that some of the remaining 88% of the items would be obsolete in 29 years and 4 months, or just about eight months before the final payment falls due.

FAMOUS PEOPLE DO FAMOUS THINGS

Want to learn all the facts of history, without the frills? Just ask any bright school child. As an example, take this bit of information we learned from the third grade daughter of a friend of ours, "Ponce de Leon organized the first youth center."

CLOSING THAT GAP

Russian technologists are reported to spend over 50% of their waking hours, reading technical journals, only 35% of their time is spent on actual experiment. Now if we could only add similar American journals to their required reading, perhaps we could sabotage their experimental efforts for years.

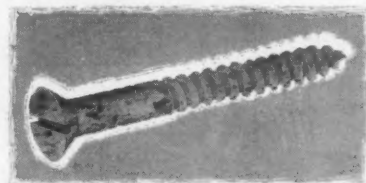
PUSHING THE PANIC BUTTON

What kind of emergency equipment does your plant have? In the data processing room at Chicago Aerial Industries in Barrington, Ill., hangs a glass encased abacus with the cryptic message, "In case of emergency—break glass."

MATH OVER LIGHTLY

To weigh 1 to 121 pounds, in whole numbers only, it takes only a balance beam scale and five weights. What are the weights? (see answer on page 81)—from Greif-Associates, Inc.

FLOATING FASTENER



When a large order for cork screws was received at Dumont Industrial Screw, the materials engineer misinterpreted the configuration for material specifications. As a result, the engineers at the company have developed a unique, lightweight, floating fastener—a cork screw. Made of pure cork, this fastener has no known application, at this time. However, because of its light weight and floating characteristics, research and development engineers are working out a list of possible uses.

WHAT'S IN A NAME?

The Transport Division of Boeing Airplane Company in Renton, Washington has for its address PO Box 707.

NOT ALL ARTISTS DRAW PICTURES

"All that glitters is not gold," is poor philosophical comfort for some of the inmates at San Quentin prison. At a recent art show, put on for Californians, the sale of paintings netted the prisoner-artists six bad checks.

LIMERICK CORNER

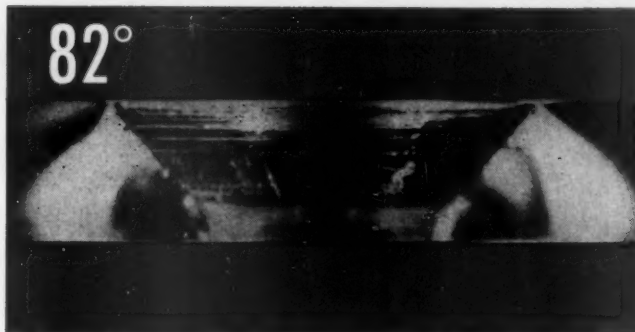
Vitamin pills packed in dog food—News Item. There once was a dog, a shaggy old gent, Whose days in fitful slumber were spent, It seems that his food, Had caused him to brood, And wonder just where the vitamins went.

"The world is a comedy to those who think, a tragedy to those who feel."—Horace Walpole

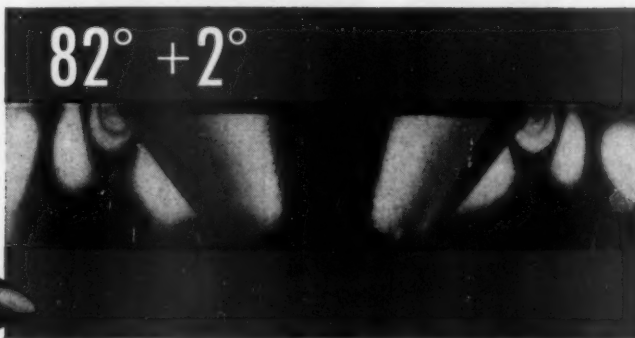
PQA*

proves it...

**this Allen
Flat Head
Cap Screw has
complete
all-around
head contact**



PQA makes it certain that an Allen Flat Head Cap Screw has contact throughout the angle of the head with the mating countersunk hole. This assures the strongest possible fastening. In this photo, made with polarized light, you can see the stress points throughout the chamfer.



Industry standards allow a tolerance of $+2^\circ$ in the head angle. Allen Flat Heads manufactured to this tolerance have greater bearing at the top of the head—shown by the stress patterns in this polarized light photograph.

*PRODUCT QUALITY ASSURANCE

ALLEN

**MANUFACTURING COMPANY
HARTFORD 1, CONNECTICUT, U.S.A.**

Plant at Bloomfield, Connecticut

Warehouses in Chicago, Cleveland and Los Angeles

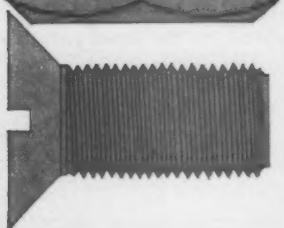
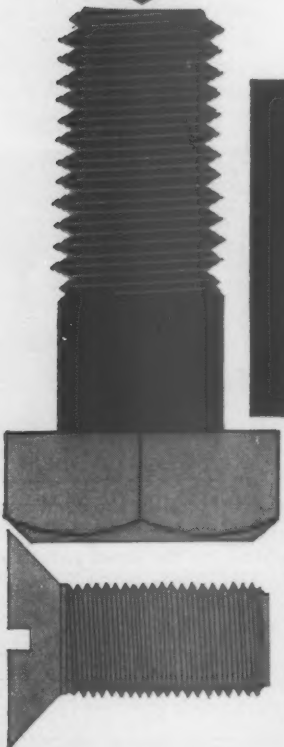
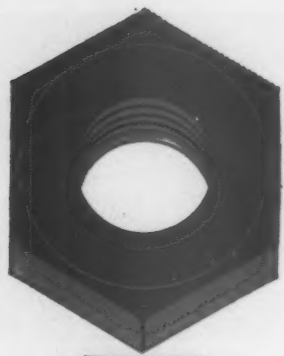
Genuine ALLEN products are available only through your ALLEN Distributor. He maintains complete stocks close by to help cut your freight costs, inventory, warehousing and handling. He offers fast, single-source service. He knows ALLEN products. And he makes ALLEN Engineering Service available to you any time. Call him!



Industry also allows a tolerance of -2° in the head angle. *But Allen does not utilize this negative tolerance.* The reason—it is entirely possible to have head seating efficiency reduced because of excessive interference in the head-shank area. The photo shows high bearing stress in this area—with risk of breaking prematurely.

PRODUCT QUALITY ASSURANCE is the symbol of unquestioned quality at ALLEN. It stands for constant quality control every step of the way—your guarantee of quality and reliability.

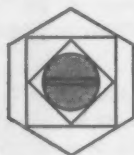
Use postpaid card. Circle No. 236



Imagineering

There's a bold, new look at Screw & Bolt. To the industrial designer, this new look means infinite design capability. Thousands of samples of specials we have made attest to our ability to make most any fastener you can design. Screw & Bolt's **Imagineering** is at your disposal, too! ■ Send for our booklet "Imagineering," and when you need threaded fasteners or parts, think of Screw & Bolt!

VMA 9558 D



SCREW AND BOLT CORPORATION

OF AMERICA • P.O. BOX 1765, PITTSBURGH 36, PA.

Plants: Pittsburgh, Pa. Gary, Ind. Southington, Conn. Norristown, Pa. • Warehouses: Portland, Ore. Denver, Colo. Atlanta, Ga.

Imagineering . . . for greater fastener progress

Use postpaid card. Circle No. 237

Assembly & Fastener Engineering

WHAT'S NEW IN EQUIPMENT

For information on any equipment listed here, use the postpaid card opposite page 68. Just circle the number on the card matching the number following the description. We'll do the rest.

ADJUSTABLE DIP SOLDER UNIT FOR PRINTED CIRCUITS

An adjustable dip soldering fixture for printed circuit boards eliminates the need to build custom fixtures for different sizes and types of printed cards.

The fixture is quickly and easily adjustable over a wide range. All parts are made of high temperature resistant materials and will not contaminate the solder pot.

The cards are gripped by high-temperature silicone-rubber guides. Each guide has four different grooves to accommodate card thicknesses from .015 to .125 inches.

Defiance Printed Circuit Corp., 144 Commercial St., Malden, Mass.

Use postpaid card. Circle No. 1

HAND GUN DISPENSES TWO PART COMPOUNDS, EPOXY

An all-metal, manually operated gun, designed for use with standard 2½ oz. and 6 oz. cartridges, dispenses one or two-part compounds, adhesives, epoxys, polysulphides and silicones.

The SP 1832 gun is ideal for general use or in the field where air pressure is not available. The cartridges are easily removed from the gun, and may be stored in a refrigerator for later use. Material wastes are reduced by as much as 75%.

Pyles Industries, Inc., 20855 Telegraph Rd., Detroit 21, Mich.

Use postpaid card. Circle No. 2

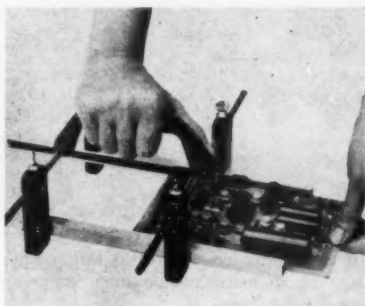
EASY HEIGHT ADJUSTMENT ON ASSEMBLY LINE CHAIRS

A line of adjustable posture chairs have a wide range of basic heights, each adjustable 7½" upward instantly, without the use of tools.

The Quick-Height chairs are made in the swivel-nonswivel seat design to meet the specific requirements of usage at any given time. The posture seat is designed for comfortable seating at assembly work benches, and helps reduce employee fatigue.

Toledo Metal Furniture Co., 1250 Hastings St., Toledo 7, Ohio.

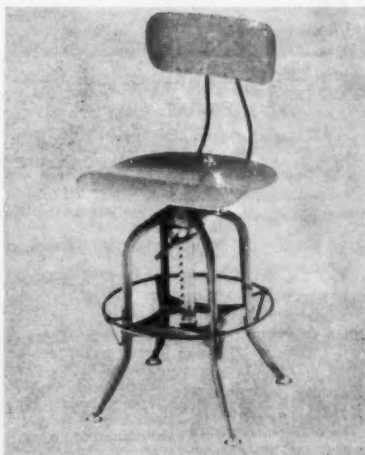
Use postpaid card. Circle No. 3



See No. 1



See No. 2



See No. 3

INKLESS RECORDER RUNS 50 DAYS WITHOUT CHANGE

An inkless event recorder can operate more than 50 days with a change in charts.

The 620-event recorder is available in both a 10-channel model and a 20-channel model. The recorder can be used for time, motion, efficiency and quality control studies.

Esterline Angus Instrument Co., Inc., P.O. Box 596, Indianapolis 6, Ind.

Use postpaid card. Circle No. 4

CONVERTS SHELVEING TO FULL DRAWER STORAGE

A low cost drawer which glides on a heavy duty ball bearing suspension system can be used to convert standard metal shelving to full suspension, visible storage drawers.

The Cribdrawer, when open, exposes all parts fully classified and ready for selection. It is available in a wide variety of sizes and can be used in both new installations and in the conversion of existing metal shelving.

Cribdrawer Co., 38 Maplewood Ave., Philadelphia 34, Pa.

Use postpaid card. Circle No. 5

HYDRAULIC GUN SETS UP TO 1200 RIVETS PER HOUR

An improved hydraulic gun is capable of setting up to 1,200 Pop rivets per hour and permits operators 25% more working radius than a previous model.

The Model "C" gun is furnished with an air-to-hydraulic converter, and operates from 75 psi air pressure. It is especially suitable for production line work since it combines high speed with portability.

Shelton Division, United Shoe Machinery Corp., Shelton, Conn.

Use postpaid card. Circle No. 6

WIRE POINTING MACHINES FOR THREADING WIRE ROD

Wire pointing machines which are used in connection with threading wire rod into wire drawing dies have hori-

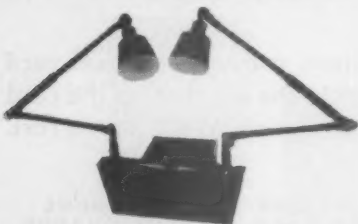
zontal rollers and a cutter for cutting wire ends.

The larger machines Type III-V can be supplied with horizontal and vertical roller sets. The motor is fitted into the machine and pedal control. The hardened rollers are spur gear driven with calibrations geometrically stepped to obtain uniform results.

Straus-Artys Corp., 45 No. Station Plaza, Great Neck, New York.

Use postpaid card. Circle No. 7

SHADOWLESS LIGHTING FOR MICRO-MINIATURE ASSEMBLY



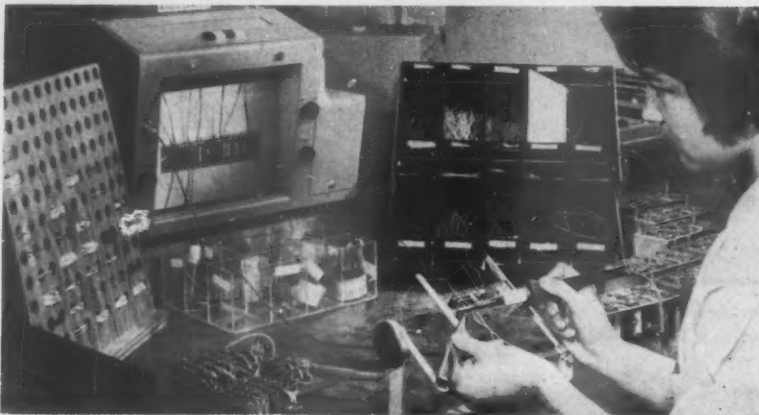
A work lamp has been especially designed for glare-free, shadowless, concentrated lighting in micro-miniature precision assembly and inspection.

The Model 5917 stereo work lamp has a two stage switch located in the base permitting high and low-level lighting. At a working distance of 12", the high position yields 400 fc, and the low position gives 60 fc of light.

Tensor Electric Development Co., Inc., 1873 Eastern Parkway, Brooklyn, N.Y.

Use postpaid card. Circle No. 8

AUDIO VISUAL SYSTEM HAS WIDE VARIETY OF USES



An audio visual system used for step-by-step assembly instruction can be used for a wide variety of applications.

The Audio Graphic System provides a synchronized voice and slide presentation of how a job must be performed. It is portable and can be set up in the field, giving servicemen complete in-

structions for installation, repair, or modification of equipment. The unit may be used also for sales training, teaching new procedures, on-the-job training and testing and inspection.

Graflex, Inc., Dept. 114, Rochester 3, New York.

Use postpaid card. Circle No. 9

FINGER COTS USED FOR CONTAMINATION CONTROL

Thin-walled latex finger cots are made by a special process that renders them "dustless." They are widely used in contamination control in the assembly of delicate components such as semi-conductors.

The cots cover only the fingers, and being tissue thin, do not restrict worker dexterity or finger sensitivity in parts handling.

The Akwell Corporation, 99 Wall St., New York, N. Y.

Use postpaid card. Circle No. 10

Armstrong Epoxy Resin Adhesive A-12 CUTS COSTS on many fastening and assembly operations

ARMSTRONG A-12, an epoxy resin based formulation, has proven to be one of the most versatile adhesives for bonding most rigid materials including metals, wood, glass, ceramics, hard rubber and thermosetting plastics. Equal results are obtained when bonding these materials either to themselves or to each other.

STRONG PERMANENT BONDS

The use of properly designed filler materials further reduces normal low shrinkage of epoxy resins resulting in exceptionally strong permanent bonds. Does not dry out or deteriorate with age. Excellent for use as gap filler. TENSILE SHEAR STRENGTHS UP TO 4000 PSI WHEN BONDING STEEL TO STEEL.

100% SOLIDS—NO VOLATILES

This two component, 100% solids system consists of Part A, resin, and Part B, activator, both of which contain inert filler materials. No other volatile, toxic, explosive or temperature sensitive curing agents are required.

VERSATILE—EASY TO USE

For most applications proportioning of Parts A and B can be accomplished using equal parts by weight or volume. Only contact pressure is required. Curing can be either at room or elevated temperatures.



SEND FOR TRIAL TEST KIT OF A-12

Contains one tube each of Parts A and B, disposable mixing cups and detailed instructions. Price \$1.00 each, net, F.O.B. Warsaw, Indiana; mailed postpaid in U.S. or Canada if payment accompanies order.

WRITE FOR 16-PAGE BROCHURE

Gives technical data on the complete line of Armstrong epoxy resin adhesives. Includes information on epoxy resins for potting, casting, laminating work.



Use postpaid card. Circle No. 297



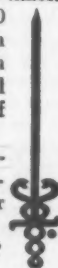
Don't blindfold him!

THE AWESOME-looking instrument in the picture above is an electron microscope. Through it, a cancer researcher can observe the detail of a cancer cell—magnified 100,000 times.

The microscope costs \$35,000 and was paid for by American Cancer Society funds—which support 1300 scientists, all working to find the cause of cancer, and its prevention.

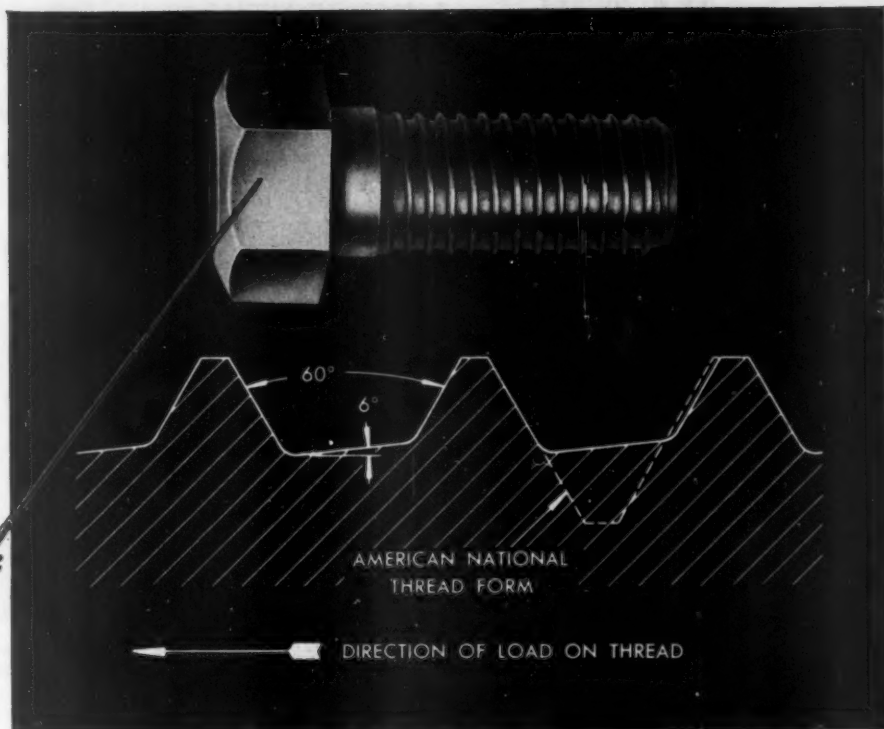
Don't blindfold cancer research. Give to it. Send your contribution to CANCER, c/o your local post office.

AMERICAN CANCER SOCIETY



Assembly & Fastener Engineering

NAT'S
quick facts
about
Fasteners...



Can **any** fastener actually **become tighter** in service?

WELL, HARDLY. NOT JUST **ANY** FASTENER...

But self-locking, extra-strength LOK-THRED® bolts, studs and screws *do*, and even after long service you can expect their breakaway removal torque to average about 70% higher than at installation.

Here's the reason. Just take a look at the LOK-THRED profile. Notice the extra-wide root? And its converging angle? It's held, strictly by design, to exactly 6 degrees.

Now, see what happens, as you drive any LOK-THRED fastener. It re-forms the metal of the receiving thread, squeezing out every void, and forming an intimate metal-to-metal contact. And each of the angled roots becomes a 6-degree tapered wedge, with the loading constantly pulling against it to make its anchorage even firmer.

That's why LOK-THRED fasteners actually *do* become tighter in service. They're self-sealing, too... fluids can't leak past them. And yet they're fully reusable... require no selective fits... can be used with ordinary tools.

Take our word for it, there are plenty of reasons* why LOK-THRED is superior for many kinds of fastening... and we'll be glad to help you develop any applications to your own products.

*They're all given in National's LOK-THRED booklet, with plenty of supporting data. Write for your copy.



The National Screw & Mfg. Company • Cleveland 4, Ohio

California Division, The National Screw & Mfg. Company • 3423 South Garfield Avenue, Los Angeles 22, California

The quickest most practical way to put strong threads in soft materials the **TAP-LOK**[®] INSERT



SLOTTED

IN SOFTER METALS AND PLASTICS... Has full V-form external threads to provide maximum locking torque and permit wide choice of mating hole sizes. Recommended for soft aluminum, zinc die castings, sand castings and plastics. Meets requirements of MIL-MS-35914.



H-SERIES

FOR HIGHER STRENGTH MATERIALS... Has heavy wall and truncated root external thread and three-hole cutting edges for hard-to-tap higher-strength materials and to meet MIL and other specs calling for Class 3B thread fit for gaging after installation.



F-SERIES

ELIMINATES CHIPS... The F-Series Form-Lok self-tapping insert is thread forming and firmly locks itself in the base material. Available from stock in sizes #4 through 1/2".



W-SERIES

FOR WOOD... Has coarse pitch external threads offering maximum strength in combination with ability to be driven into thin sections without splitting them. For furniture, cabinets and other wooden parts where strong, permanent threads are needed, or that are frequently assembled and disassembled.



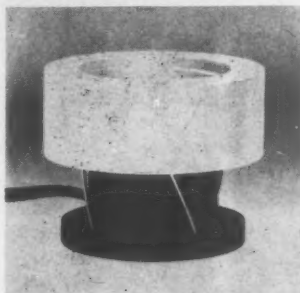
Another fastener development from —

TAP-LOK  **GROOV-PIN CORPORATION**

1135 Hendricks Causeway, Ridgefield, N. J.
WHITNEY 5-6790

Use postpaid card. Circle No. 240

NON-MAGNETIC VIBRATING FEEDER FOR MICRO PARTS



A vibrating feeder for very small parts, down to fine powders is 3" in diameter and 2 1/2" high. It can be built right into work stations.

The feeder has a plastic bowl and is non-contaminating. There are no external magnetic effects. It may be machined for any feed or escapement application.

Minimus Company, 1582 Manning Ave., Los Angeles 24, Calif.

Use postpaid card. Circle No. 12

EXTRACTING TOOL REMOVES PINS AND STUDS

An extracting tool, made in a manual and hydraulic model, removes pins, tubes, shafts, bushings and studs.

The unit is essentially a collet with hardened steel jaws. Pulling on the

collet tightens the jaws on the work piece.

Manual Model 50 has a capacity of 1/4 to 1/2", and is wrench operated. Hydraulic operation is by hose connected hand pump or by portable motor driven pump.

Wright Tool Co., 4314 N. Woodward Ave., Royal Oak, Mich.

Use postpaid card. Circle No. 13

RECOILING NYLON HOSE HOLDS 200 PSI PRESSURE



A nylon air hose that stretches and recoils will hold up to 200 psi air pressure.

Another feature of the Nycoll hose is a special non-slip ferrule on the compression elbow fitting. This type of assembly locks on the smooth surface of

MELLOWES LOCK WASHERS

Protected by



PLUS Chromate Treatment GIVE YOU 3 ADVANTAGES

1. **Eliminate Hydrogen Embrittlement** — The 3M Mechanical Plating System is non-electrolytic. It eliminates the possibility of hydrogen embrittlement. Broken lock washers in completed assemblies create costly and frustrating situations. Now HYDROGEN EMBRITTLEMENT is no longer a problem.
2. **Heavier Coating at Same Cost** — "DYKO" Metal Plating gives Mellowes Lock Washers a heavier, more consistent protective coating at no increase in price. Mellowes Standards call for .0003" coating thickness when commercial plating is required.
3. **Increased Corrosion Resistance** — It is MELLOWES practice to apply clear chromate treatment to mechanically plated lock washers. This increases its corrosion resistant qualities and preserves the true metallic finish of the plating. However, iridescent chromate (which is bronze-like in color and greatly increases corrosion resistance) is strongly recommended when corrosion resistance is the primary reason for plating. When you specify Mellowes Plated Lock Washers, either chromate treatment is available at NO ADDITIONAL COST!

Get The Complete
"DYKO" Story

For further information on "DYKO" Metal Plating, write for Illustrated Brochure and Salt Spray Test Graph which explains both the clear and iridescent chromate treatments.



THE Mellowes CO.

143 E. Nash St., Milwaukee 12, Wisconsin

Manufacturers of a Complete Line of Lock Washers in all Standard and Special Sizes in Steel, Stainless Steel, Non-Ferrous or Plated in Bulk, JOB-PAK, Coin Pak or Special Packaging.

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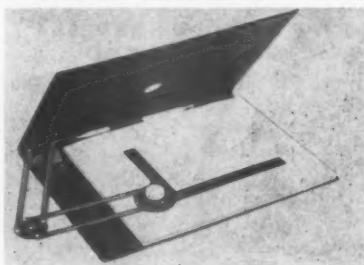
Assembly & Fastener Engineering

the hose and permits unobstructed air flow. If overtightened or subjected to severe pulling, the fitting will not pull off.

Nycoil Company, Westfield 4, N. J.

Use postpaid card. Circle No. 14

PORTABLE DRAFTING KIT IS EASILY STORED



A portable drafting machine especially designed as a personal kit for home and field use folds into a compact unit for easy storage.

The Draftette measures $9\frac{1}{2} \times 13 \times 1\frac{1}{2}$ ", and includes the drafting instrument with a 3x5 or 4x6 scale, a 180° protractor, drawing paper and pencil.

Draftette Co., P.O. Box 794, Beverly Hills, Calif.

Use postpaid card. Circle No. 15

ADJUSTABLE TRACK FEEDER HANDLES HEADED PARTS



A standard small-parts feeder features a divided track, having adjustment in width, which can be used for headed parts. The feeder is designed to operate with various types of assembly and other equipment.

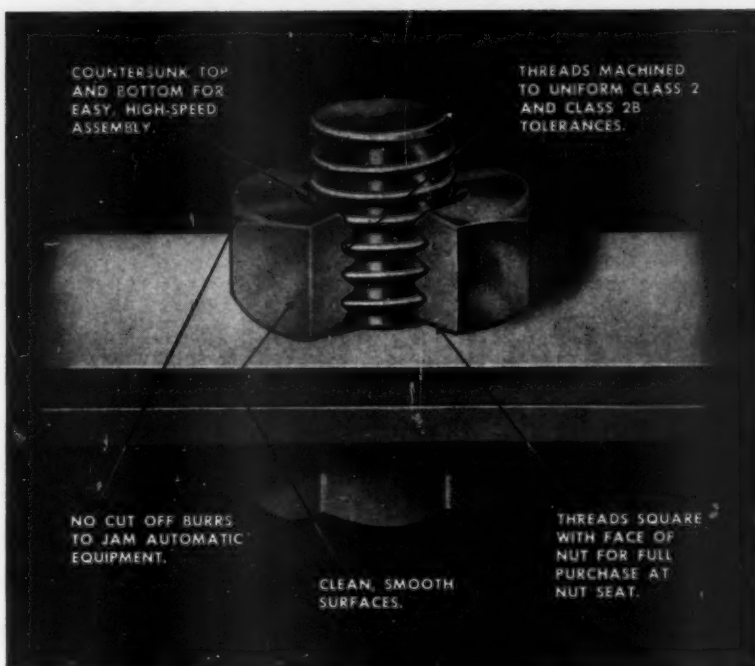
The model FE-101 is six inches wide and has a storage capacity of 150 cubic inches. Model FE-104 is ten inches wide and has a capacity of 700 cubic inches.

Dixon Automatic Tool, Inc., 2300 23rd Ave., Rockford, Ill.

Use postpaid card. Circle No. 16

FLAT BELTS FOR CONVEYING ON ASSEMBLY LINES

Flat belt for light-duty conveying, elevating and power transmission is made of specially woven cotton duck. It is frictioned with oil- and heat-re-



CORNELL

"Machined from the Bar" BRASS NUTS

REDUCE ASSEMBLY COSTS



"Machined from the Bar" brass nuts can save you countless production dollars yearly by speeding your assembly operations and reducing downtime and rejects to a minimum. These precision nuts handle easily, spin on smoothly, tighten securely and, once in place, stay in place.

We are specialists in "Machined from the Bar" brass nuts. This is our only product. Our method of manufacture assures that every nut is a precision product held to close tolerances and checked with go and no-go gauges. This uniformity speeds hand operations and permits trouble-free performance of portable and hopper-fed, high-speed nut setters.

Remember, "Machined from the Bar" brass nuts are available at no extra cost. Standards are available "off the shelf", shipped the same day the order is received.

Call, wire or write today: Gene Carroll, Yonkers 8-9400. Teletype, Yonkers 4356.

Remember... "Machined from the Bar" at no extra cost!

CORNELL

MANUFACTURING COMPANY, INC.

12 SAW MILL RIVER ROAD, YONKERS, NEW YORK

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with MILFORD "MULTIPLES!"

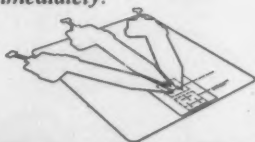
The "Multiples" that keep assembly costs down while increasing production and profits are standard Milford rivet-setting machines operating as a unit. The Milford line is designed as "building blocks" for multiple units to suit your automatic riveting needs. They can be flexibly regrouped to meet the next, low cost assembly requirement.

The narrow wedge shape of Milford's No. 56 and 57 permits grouping to set rivets head to head and, when grouped, the cost of labor and burden is divided by the number of heads in the unit. Write for Milford's Engineer's Kit, so you can explore the profit multiplying possibilities of Milford "Multiples" first hand. Or we'll be glad to quote on your needs immediately.



MILFORD RIVET & MACHINE CO.

MILFORD, CONNECTICUT • NORWALK, CALIFORNIA
ELYRIA, OHIO • AURORA, ILLINOIS • HATBORO, PA



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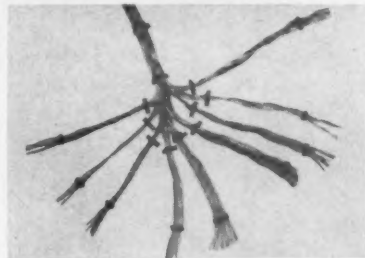
sistant neoprene. All edges are neoprene-sealed.

The Manheim flat belt is ideal for small or light parts conveying in assembly line operations. It is also an economical and long-lasting power transmission belt for light-duty drives.

Manheim Manufacturing & Belting Co., Manheim, Pa.

Use postpaid card. Circle No. 17

CLIPS IMPROVE HARNESS ASSEMBLY PRODUCTION



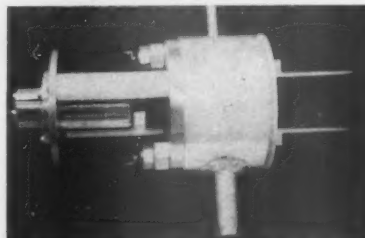
Harness clips are designed to hold assemblies in perfect order until ready for lacing and simultaneously reduce production time.

The Q-Clips are especially effective on vertical or 3-dimensional harness boards. Two round holes in the flat base are provided for easy fastening of the clips to the harness board. The split top is crimped to guide wires so they can be snapped into place with a single hand motion.

Holtronics, Electronics Components Div., 7100 Avalon Blvd., Los Angeles 13, California.

Use postpaid card. Circle No. 18

ELECTRON BEAM GUN WELDS REFRACTORY METALS



An electron beam gun is designed to weld refractory and reactive metals. It is self-accelerated and incorporates electrostatic deflection for moving the beam electronically within a three inch circle.

The Model 2025G can be operated in standard stainless steel jars or in larger chambers for production work. It is rated at 20 kv, 5 kw and can be used for evaporation of thin film deposition, button melting and zone refining.

High Vacuum Equipment Corp., 2 Churchill Rd., Hingham, Mass.

Use postpaid card. Circle No. 19

STRAIN GAGE CONDITIONER HAS AUTOMATIC SETTING

A modular strain gage and transducer input conditioner will accommodate any type of resistance strain gage or trans-

ducer. Each module contains its own individual power supply.

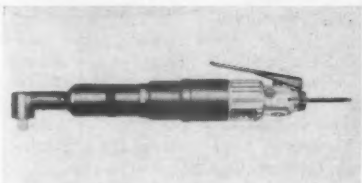
The Model 1-400 also has circuitry which will cause automatic servo balance and automatic setting of the sensitivity control with a single push-button control. The servomatic system will null to plus or minus 10 microvolts.

The modules can be used with 3 to 8 wire input calibration systems. They can perform single or double shunt resistant calibration, as well as series current calibration.

B & F Instruments, Inc., 3644 North Lawrence St., Philadelphia, Pa.

Use postpaid card. Circle No. 20

RIGHT ANGLE TOOL HAS TORQUE CONTROL CLUTCH



A series of nutrunners and screwdrivers with a right angle head have a torque control clutch. The clutch engagement is controlled automatically, rather than by the operators own thrust.

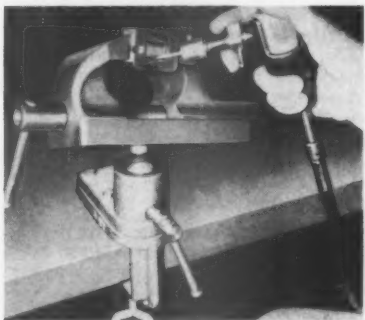
The clutch of the 31W series tool is adjustable from 5 to 100 ip. Its jaws automatically disengage when the preset torque is reached.

Carrying a rating of 1/4 machine screw, the tool is available in six models.

Buckeye Tools Corp., 5003 Springboro Pike, Dayton 1, Ohio.

Use postpaid card. Circle No. 21

WISE CLAMP PERMITS FAST LOCATION CHANGE



A bench clamp that bolts to the Tilt-Swivel Vise makes possible rapid mounting and change of bench location, simply by loosening the clamp screw.

The ball joint of the vise permits swiveling through 360° and tilting to 30° up or down in any position. Work is held securely in the position most convenient for the operator, and with the clamp accessory, the entire assembly can be quickly moved from one position to another.

Hyprez Div., Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill.

Use postpaid card. Circle No. 22

Patent No. 2,884,038

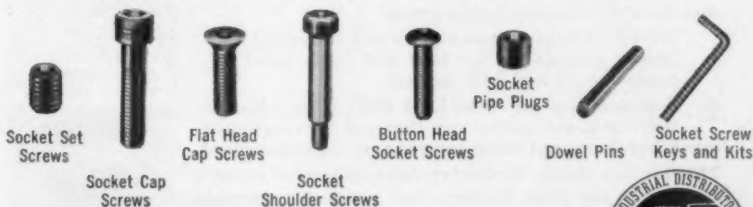
Patent No. 2,923,340

Blue Devil® LED-LOK® SAF-LOK® SOCKET SCREWS

LED-LOK is the perfect seal for hydraulic applications as well as air and any type gas. It's designed to give good results in minor vibration problems. Screw is pre-assembled and available in all standard socket screw sizes.

SAF-LOK is the answer to severe vibration problems requiring high torque. It's available in a choice of locking inserts—brass, bronze, aluminum or stainless steel capable of withstanding high operating temperatures.

OTHER GREAT BLUE DEVIL PRODUCTS



MEMBER ASMEA

Sold Only Through Authorized Industrial Distributors

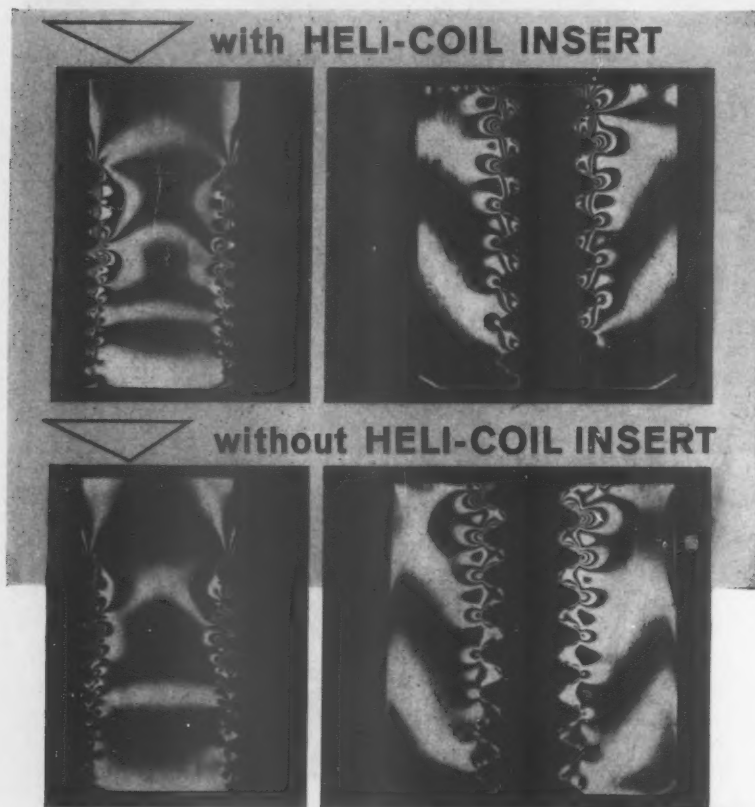
SAFETY SOCKET SCREW CO.

6517 N. Avondale Ave., Chicago 31, Ill. • Telephone RDney 3-2020

WAREHOUSES AT: LOS ANGELES • DETROIT • NEW HAVEN • NEW YORK CITY

Use postpaid card. Circle No. 244

How HELI-COIL® Stainless Steel Wire Inserts Eliminate Stress Concentration and Insure Maximum Strength in Threaded Assemblies



Made of stainless steel wire, precision-rolled to a diamond-shaped cross-section, *Heli-Coil* screw thread Inserts provide two exclusive characteristics directly related to threaded assembly strength:

1. **Permanent, resilient threads between the threads of the male and female assembly members.** These eliminate stress concentrations (upper photos) by distributing the load evenly along the full length of thread engagement in both members. By contrast, note the sharp stress concentrations (lower photos) around the first two threads of the conventional assembly.

NOTE: Diagrams at right show how *Heli-Coil* Inserts compensate for lead and angle error between female and male threads.

2. **A superior surface finish (8-15 RMS).** This holds friction loss to a minimum and, thus, provides maximum, consistent clamping load at any given wrench torque load.

RESULT: No stress concentration; improved fatigue strength in the male member; and a stronger assembly under all conditions.

There is a complete line of *Heli-Coil* products for every thread need: inserts, taps, tools and gages. Let us help with your design and application problems. Write today for complete information.

3146



HELI-COIL CORPORATION
3111 Shelter Rock Lane, Danbury, Conn.

In Canada: ARMSTRONG BEVERLEY ENGINEERING LTD., 6075 Jeanne Mance St., Montreal 15, Que.
Use postpaid card. Circle No. 245

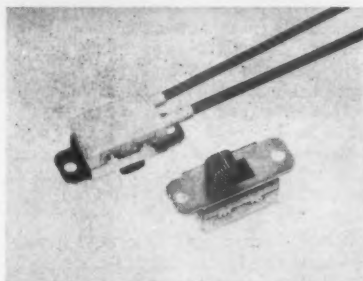
SCREW THREAD ENGAGEMENT



CONVENTIONAL

WITH HELI-COIL INSERT

APPLIANCE SWITCH MOUNTED IN 1/2" SPACE CLEARANCE



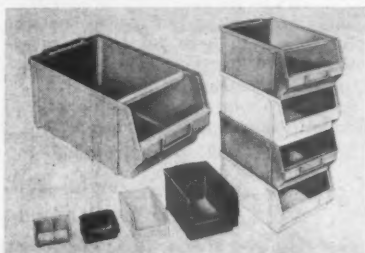
A six amp slide switch for household appliances, power tools and other electrical equipment needs only 1/2" mounting clearance.

The Series SS-37 is 1 5/8" long, 1/2" wide and 1/2" deep, excluding the trigger. Lead wires do not affect the clearance because the leads enter the switch base from the ends and connect to recessed terminals.

Electronic Components Div., Stackpole Carbon Co., St. Marys, Pa.

Use postpaid card. Circle No. 23

PARTS BOX DESIGNED FOR STACKING EASE



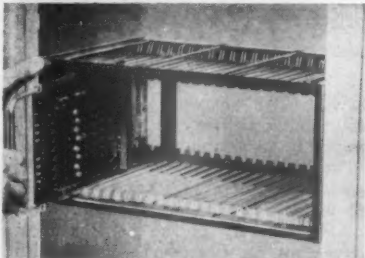
A plastic parts storage box is fitted with a stacking brace, allowing safe, high stacks of fully loaded boxes.

The new Plastibox PB-4, is also made in a larger size than previous models. It measures 13x8x6".

G. B. Lewis Co., 269 Montgomery St., Watertown, Wis.

Use postpaid card. Circle No. 24

WELDED WIRE RACK HOLDS PRINTED CIRCUIT BOARDS



A printed circuit board holder used in electronic components is made as a welded wire assembly. It features specially formed parallel guide wires which are welded in pairs to longitudinal support wires. The boards are held firmly

Assembly & Fastener Engineering

in place by the natural resilience of the wire.

Advantages of these board holders are improved air circulation and better heat dissipation, less tendency to accumulate dust and improved visibility for trouble shooting.

E. H. Titchener & Co., 8 Titchener Place, Binghamton, N. Y.

Use postpaid card. Circle No. 25

PLIERS REDESIGNED FOR USE IN CLOSE AREAS



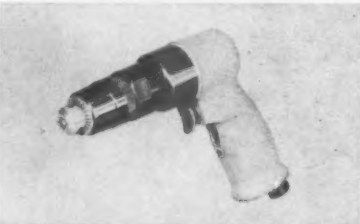
The trend to miniaturization and demand for hand tools designed for working in deep, confined areas has brought about the redesigning of four hand tools to meet the need.

The midjet diagonal cutter, the long narrow chain nose plier, the extra fine end cutting nipper and the long round nose plier now feature handles which have been lengthened to six inches. The tools also have cushion grips and leaf springs for easier manipulation.

R. N. Hunter Sales Corp., 9851 Alburts Ave., Santa Fe Springs, Calif.

Use postpaid card. Circle No. 26

VARIABLE DRILL SPEEDS IN PORTABLE AIR TOOL



A line of compact air drills in straight and offset models have a drilling capacity up to 5/16" and a choice of eight speeds for efficient drilling of a wide range of materials including steel, cast iron, non-ferrous metals, and plastics.

Series 94 drills are available in straight models with lever throttle or pushbutton throttle, and offset grip models with trigger throttle. Weight ranges from 1 1/2 to 2 1/2 pounds. Speeds available range from 500 to 16,000 rpm.

Thomas C. Wilson Co., 22-11 44th Place, Long Island City 1, N. Y.

Use postpaid card. Circle No. 27

FEATURES DUAL STRAIGHTENING ARBORS

Model No. 112A-TC automatic wire straightener has dual straightening arbors revolving in opposite direction,



HUBBELL COLD HEADING MAKES THEM FASTER AND BETTER

Small fasteners like these Hubbell cold headed parts represent an area of saving often overlooked by management, who give careful attention to the cost and design of major components and little or none to the parts that hold them together. Yet here is the area where savings can be effected most easily and quickly.

Why pay for special tolerances and secondary operations when Hubbell engineers can design and mass produce a cold headed part that is stronger, cheaper and more uniform. For example, all of the above, and thousands more like them, have

been specially designed for Hubbell cold heading. And each one helped to make the end product faster and better.

Investigate for yourself. Simply send us a blueprint of the part or a sample for analysis. Our engineers will gladly estimate.



This quality can be your greatest production economy. For standards or specials, call Bridgeport, EDison 3-1181.



Quality

FASTENERS

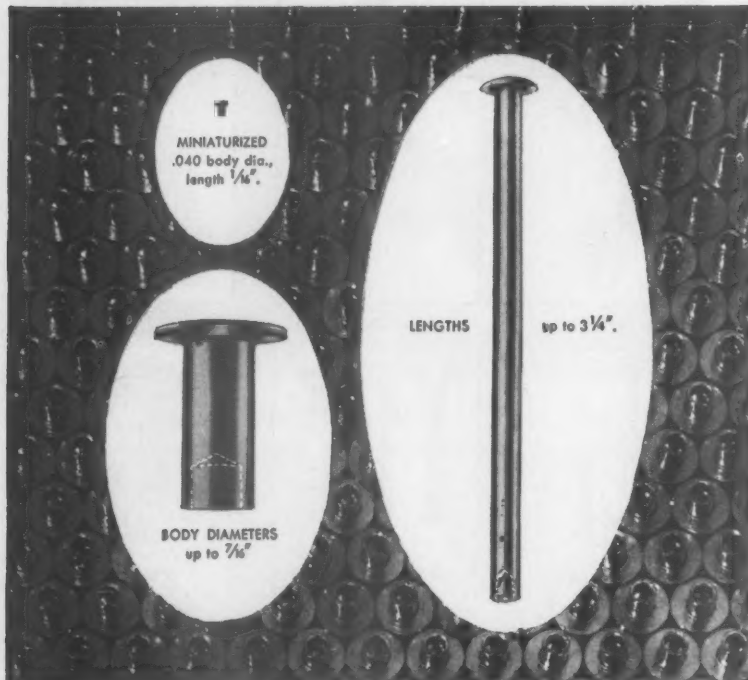
HARVEY HUBBELL, INCORPORATED

Machine Screw Department, Bridgeport 2, Connecticut

See the Hubbell Fastener Catalog in Sweet's Product Design File 10a/Hu.

Use postpaid card. Circle No. 246

Look at this Size Range of Semi-Tubular Rivets... *it's the way to lower cost*



Miniaturized components and also large complete assemblies can now have all the money-saving advantages of using single and multiple automatic riveting. This is due to the wider size range of semi-tubular rivets now available and which can be used in conjunction with motor and pneumatic driven automatic riveting machines.

Today, there is hardly a fastening problem, involving even fragile materials, that does not warrant consideration of low-cost semi-tubular rivet setting.

Our Factory Riveting Specialists are ready to help you obtain the **REAL COST FACTS** on your own specific fastening problem. There is no obligation.



FOR YOUR FILES

Chicago Rivet Catalog describes 1388 standard tubular and split rivets and 25 single and multiple automatic rivet setters.

AIR-POWERED RIVETING

contains description and specifications of 8 single, multiple riveters — also rivet setters designed for automated operation.



Chicago Rivet & MACHINE CO.

946 So. 25th Ave., Bellwood, Ill. (Chicago Suburb)
Branch Factory: Tyrene, Pa.

Use postpaid card. Circle No. 247

eliminating the twisting and spiral effects normally produced at higher speeds.

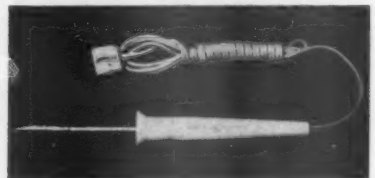
The machine is especially useful to the fabricators of high tensile wire, spring, tool steel, stainless, and alloys where twisting is undesirable for subsequent operations.

Other features include pendant mounted controls, J.I.C. approved control panel, lever action cut-off slide head, variable feed, air brake, quick retracting shutter bar and all steel base.

George C. Patterson Machine Co.,
3409 Trumbull St., Cleveland 15, Ohio.

Use postpaid card. Circle No. 28

LOW WATTAGE SOLDERING IRON FOR ASSEMBLY USE



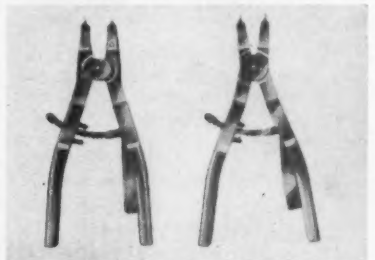
A low wattage, plastic handled soldering iron for assembly use in electronics, communication and allied industries operates on 120 V.

The Penline 120 has a calrod heating unit in the ironclad tips, giving maximum heat and fast tip temperature recovery. They are presently available in 30-watt and 50-watt models.

General Electric Co., Schenectady 5, New York.

Use postpaid card. Circle No. 29

RETAINING RING PLIERS HANDLE WIDE SIZE RANGE



A line of retaining ring pliers in a wide range of sizes can handle rings from 1/8" to 10" diameter. They are available in three types, internal, external and universal pliers with adjustable pivots for either internal or external type rings.

Owatonna Tool Co., Owatonna, Minn.

Use postpaid card. Circle No. 30

WIRE UNIT PRODUCES HIGH RATE OF CUTS

A variable speed wire straightening and cutting machine will produce torsion straightened lengths of alloy, high-carbon, stainless steel and music wire at greater speeds than previously possible.

Featured in the Model 300V are two counter rotating, 5 station, high speed

Assembly & Fastener Engineering

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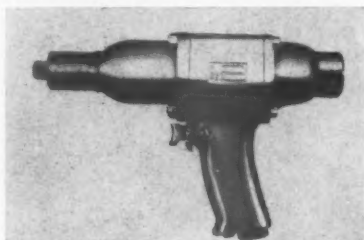
straightening arbors. Angled electric control panel for one position operation; new sensitive limit switch; and a solenoid operated roll type clutch.

The unit is arranged for high speed cutting of 12,000 cuts per hour, up to 8" in length.

Mettler Machine Tool Inc., Boulevard Industrial Park, New Haven 4, Conn.

Use postpaid card. Circle No. 31

TORQUE CONTROL WRENCH HAS FAST IMPACT SPEED



A torque control air impact wrench features fast run down and impact speed while holding close torques.

The J-24T wrench has a hydraulic amplifier which shuts the tool off when desired torque is reached. The torque sensing device is an integral part of the driving spindle.

The tool can be quickly and easily adjusted for a range of 20 to 100 ft.-lbs.

Rotor Tool Co., 26300 Lakeland Blvd., Cleveland, Ohio.

Use postpaid card. Circle No. 32

TAPE CONTROLLED UNIT DRILLS CIRCUIT BOARDS

Designed to produce hole patterns in electronic printed circuit boards, the PCB automatic layout machine used a modified GE Mark II numerical positioning control with a tape reader programmed by a Flexowriter.

Four hydraulic-feed drilling units can be used, adjustably mounted on the cross rail. Table motion is 15" side to side and 11" front to back.

Leland-Gifford Co., Worcester 1, Massachusetts.

Use postpaid card. Circle No. 33

CONVEYORIZED SOLDER UNIT HAS HIGH PRODUCTION RATE

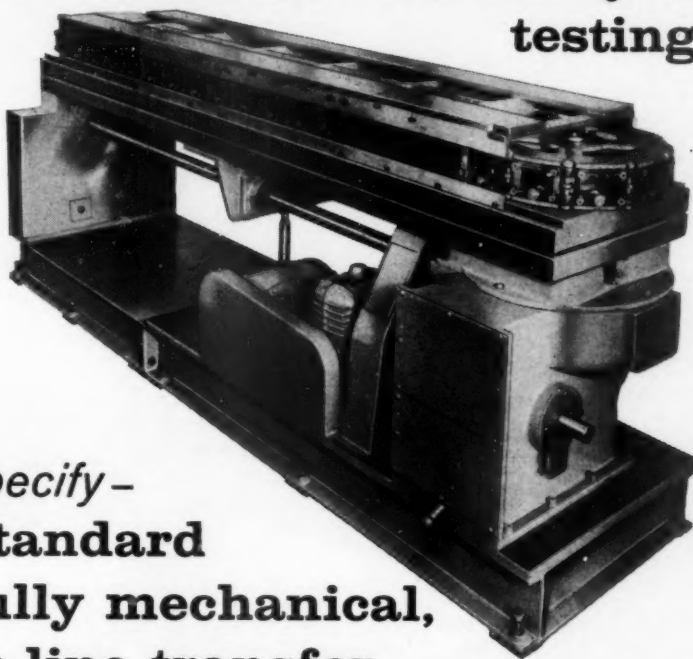
A conveyORIZED soldering furnace is suitable for a wide variety of high-volume production soldering. It is especially adaptable for automatic soldering of small electrical and electronic components. It can also be used in most manufacturing operations requiring high quality, uniform soldered connections.

The unit has three overlapping zones of temperature control for total heating of its nine foot length. Encased in stainless steel, there is a three-section removable top for inspection and maintenance.

K. H. Huppert Co., Dept. AE-3, 6840 Cottage Grove Ave., Chicago 37, Ill.

Use postpaid card. Circle No. 34

for vital cost reductions in automatic assembly & testing



specify - **Standard fully mechanical, in-line transfer type, indexing unit - STA18**

This is a precision transfer unit and machine base designed to be the main standard component in a wide range of automatic production and assembly machinery. It is self-contained and completely standard — ready for you to tool for your product.

The STA18 is available in 5 standard lengths, from 27 to 63 work carriers. It is fully mechanical. The main transfer drive is a cycloidal cam using 120° rotation for fast, smooth index and 240° rotation (dwell) for tool and work actuation. Transfer accuracy is within $\pm .003$ ".

Standard Tool also manufactures a complete line of cam operated Rotary Indexing Units . . . and other standard machine components.

The ST-A9AB for light to medium duty has 4 to 20 stations — with basic accuracy of $\pm .001$ at 4" radius and precision accuracy of $\pm .0005$ at 6" radius. The ST-A9B for heavy duty has 8 to 24 stations, with basic accuracy of $\pm .001$ " at 7" radius.

**Write for bulletins No. 19 and No. 26
for complete engineering specifications.**



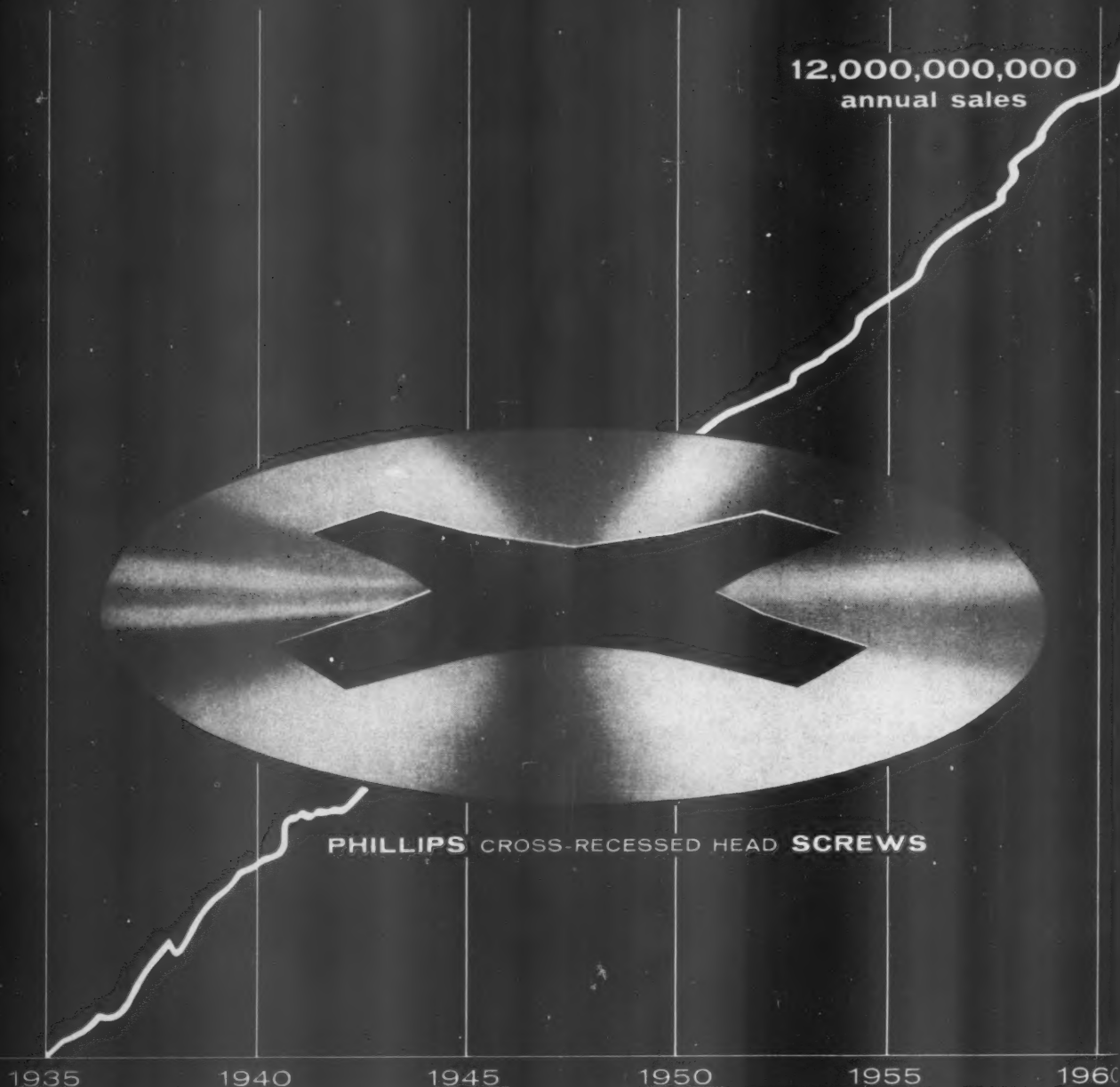
**MACHINERY
DIVISION**

Standard Tool & Manufacturing Co.

710 SCHUYLER AVENUE • LYNDBURST, NEW JERSEY

Better Products at Lower Cost through Better Methods

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A 12-billionfold vote of approval

The Phillips Cross-Recessed Head was introduced in 1935, and first used in industrial assemblies in 1936. Today, annual sales total over 12,000,000,000 screws.

There are two fundamental reasons for this impressive endorsement of the Phillips Head — why it is the spectacular success among many recess designs offered. First, it has exclusive mechanical advantages that assure lower costs under any production assembly conditions.

The second essential, an exacting standard of quality control procedure, has been established by the Screw Research Association Engineering Standards Committee, to assure universal dimensional uniformity of recess and driver conformation.

Are you using Phillips Head Screws at every fastening point where they can pay off in cost reduction? Why not make a "Phillips savings survey"?



SCREW RESEARCH ASSOCIATION

Use postpaid card. Circle No. 248

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WHAT'S NEW IN FASTENING AND JOINING

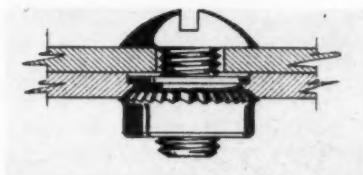
For further information on any of the fasteners or methods use the handy postpaid card opposite page 68.

THREADED INSERTS FOR THIN SHEET METAL

A self-anchoring threaded insert is used for installation in thin sheet metal. The insert, Threds, employs an angular knurl which is said to prevent loosening or turning of the insert in its hole. Applied screw tension serves to pull the knurl more firmly against the gripping surface of the hole. They are available in eight thread sizes from 4-40 to 1/4-28.

Southco Div., South Chester Corp., Lester, Pennsylvania.

Use postpaid card. Circle No. 45



See No. 45

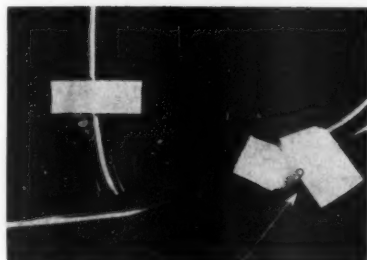
FLEXIBLE FASTENER HOLDS WIRING HARNESES

A two part flexible fastening material is used for holding wiring harnesses. One part consists of loomed memory nylon hooks; the other part is loomed memory nylon loops or pile. When the two are pressed lightly together, the hooks and loops engage, creating a substantial holding power.

Velcro can be used for holding wiring harness in two ways. The wiring harness can be mounted on a sheet of pile, and small pieces of tape are pressed around the wires. The second way is to use "back to back" tape, where the loops are on one side and the pile on the other side. When the tape is wrapped around the harness, the group of wires is held.

The Hawtwell Corporation, 3395 Venice Blvd., Los Angeles 34, Calif.

Use postpaid card. Circle No. 46



See No. 46

MOLDED NYLON QUICK RELEASE FASTENER

A molded nylon quick release fastener has recommended uses such as panel and cover closures on business machines, ground support equipment, telephone equipment and vending machines.

The NY-Q fastener is made in three sizes. The plastic smooth locking base will not damage or mar smooth surfaces or special finishes. It has a high clamping force and reusability factor.



See No. 47

The fastener design also tolerates considerable misalignment in mating sheets and it can be used successfully on curved surfaces where the radius is 4" or more.

Elastic Stop Nut Corporation of America, 2330 Vauxhall Rd., Union, N.J.

Use postpaid card. Circle No. 47

RIVETS USED TO FASTEN BACK UP MATERIALS

Rivets with specially designed long mandrels are used to fasten back-up material. They can be inserted from the same side of the work.

The POP Klip-Kit installation method is said to save time, cut material costs and insure secure fastening of the backing.

Included in the kit, are metal plates called Insul-Klips. They serve to spread the high grip strength of the rivet over a wide area.

Fastener Division, United Shoe Machinery Corp., Shelton, Conn.

Use postpaid card. Circle No. 48

DACRON-EPOXY TUBING IS HEAT-SHRINKABLE

A heat-shrinkable dacron-epoxy tubing is used for slip ring applications and is designed to provide easy and accurate slip ring positioning.

Typical shrinkage rates for a 1" i.d. tubing made of the Grade HY 418 material is .030" to .050" when heated to 150°C for ten minutes and allowed to cool at room temperature.

Tensile strength of the tubing is 8500 psi, compressive strength is 17,200 psi. It has a dielectric strength of 407 v per mil, and water absorption is .18%.

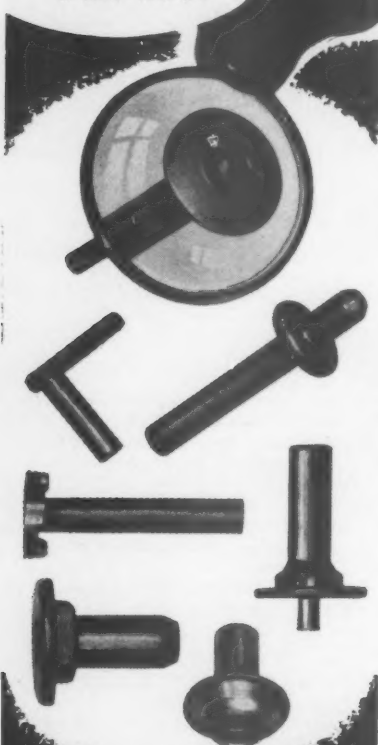
Westinghouse Electric Corp., Micarta Div., Hampton, S. C.

Use postpaid card. Circle No. 49

NEOPRENE ADHESIVE BONDS MATERIALS ON CONTACT

An all purpose neoprene adhesive that instantly bonds together upon contact virtually all similar and dissimilar materials is recommended for joining wood,

**450 per minute...
from wire!**



National High Speed Cold Headers make these interesting odd-shaped parts at the highest safe speeds ever achieved. (450 per minute in the 1/4" size).

These jobs and others are cold-forged scrapless from wire in this rugged, efficient new family of National Headers.

Do you make or use metal parts in quantity? We welcome you to Tiffin for actual machine demonstrations and a thorough study of your header needs.



NATIONAL MACHINERY CO.

TIFFIN, OHIO, U.S.A.

HARTFORD DETROIT CHICAGO

Use postpaid card. Circle No. 250

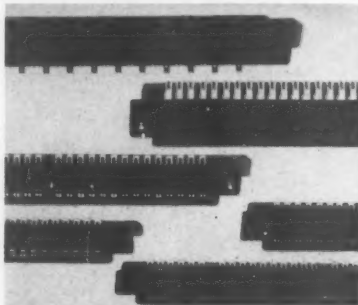
masonite, metals, rubber, paper, fiber-glass, leather, most plastics.

Application consists simply of coating the two facing surfaces, allowing a 5-15 minute period of air drying and firmly pressing the materials together. No clamps are needed. The resulting bond, which is firm but flexible, is said to be resistant to heat, water and oil.

Magic Iron Cement Co., Inc., 14215 Caine Ave., Cleveland 28, Ohio.

Use postpaid card. Circle No. 50

CONNECTORS WITHSTAND SHOCK AND VIBRATION



A line of bifurcated bellows-type printed circuit connectors provide complete and continuous contact, even when subjected to extremes of vibration and shock.

Bifurcation also provides redundant circuitry with increased reliability. Single and double row connectors in various multiples up to 130 contacts are available from on-shelf stock.

Masterite Industries, 891 W. Olive St., Inglewood, Calif.

Use postpaid card. Circle No. 51

HOSE CLAMP HAS SLOTTED HEX HEAD SCREW



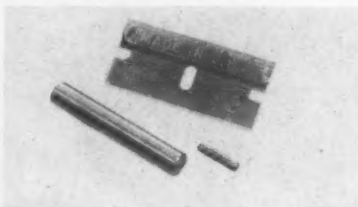
A "worm-drive" hose clamp has a deep-slotted hex head screw.

The series H clamp not only provides a deep-slotted screwdriver slot, but the 3/8" head is standard for any socket hex wrench or open end wrench.

Wittek Manufacturing Co., 4305 W. 24th Place, Chicago 23, Ill.

Use postpaid card. Circle No. 52

STAINLESS STEEL DOWEL PINS FOR ELECTRONIC USE



Stainless steel dowel pins used for instrument, electronic and missile as-

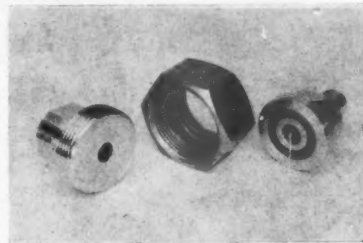
sembly have a tolerance of .0002, plus or minus.

The pins range in size from 1/32" to 1/2" dia., in increments of 32nds and 64ths. The type 416, 420, 440 and drill rod pins are manufactured to MS print.

Star Stainless Screw Co., 713 Union Blvd., Paterson 2, N. J.

Use postpaid card. Circle No. 53

TRANSISTOR BASES HAVE RINGS BRAZED IN PLACE

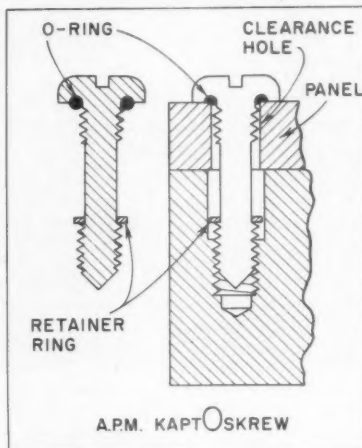


Ready-to-weld copper semiconductor bases in the full-hard condition, with integral steel rings already brazed in place are made of a special alloy. The bases are supplied with an annular projection for welding.

Standard Pressed Steel, Jenkintown, Pennsylvania.

Use postpaid card. Circle No. 54

NO NEED FOR TAPPING WITH SELF-SEALING FASTENER



A line of self-sealing captive screws, KaptOskrew, are available in thread sizes from 2-56 up to 1/4-20. Only one length is required for each thread size, but each size will accommodate all panels or covers from 1/32" to 1/4" thick. No tapping of the panel, or special tools are required for installation, and they can be used in standard clearance holes.

A. P. M. Corporation, 41 Honeck St., Englewood, N.J.

Use postpaid card. Circle No. 55

QUICK RELEASE PINS HAVE DOUBLE ACTION

Supplementing a line of single acting quick release pins, a double acting pin is pushed to install, pulled to remove.

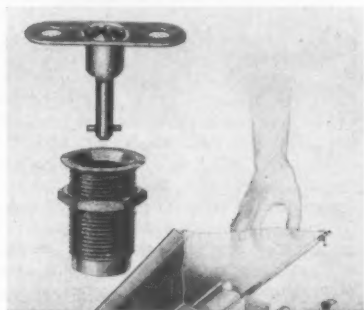
The pins are available in a ring handle, T-handle and L-handle type.

Stainless steel balls of the pins provide a positive lock against unintentional pin removal.

The Hartwell Corporation, 9035 Venice Blvd., Los Angeles 34, Calif.

Use postpaid card. Circle No. 56

ONE-TOUCH CONCEALED LATCH FOR PANELS



A concealed latch is designed so that light pressure at any point on an access panel will release the panel instantly. Similar pressure closes the panel with positive locking action.

The Touch Latch has wide application in enclosed lighting fixture design where the feature of rapid access is desirable to cut re-lamping costs.

Camloc Fastener Corp., Dept. 2-A, 14 Spring Valley Rd., Paramus, N. J.

Use postpaid card. Circle No. 57

BALL-BEARING SCREW STOPS AT PRESET LOAD



Travel of the ball nut in ball bearing screw assemblies is halted at any position along its stroke where the load reaches a preset amount. With previous actuators, travel of the nut could only be limited at the ends of its stroke by means of prepositioned stops.

The desired amount of preloading is applied to the angular-contact bearings by screwing the housing sections together or apart. Torque is transmitted through the preload unit to the ball nut, and when the load exceeds the preset amount, the housing and nut will freewheel on the stud and screw.

Saginaw Steering Gear, Div. of General Motors Corp., Saginaw, Mich.

Use postpaid card. Circle No. 58

EPOXY COMPOUND HAS EQUAL PART MIX BY VOLUME

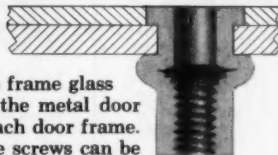
A two-component adhesive is mixed in equal parts by volume instead of odd ratios by weight. The mixing ration eliminates the need for scales, or metering or proportioning.

Bondmaster M666 compound "A" is a cherry red color and part "B" is a clear



RIVNUTS® make sturdy nutplates for door hinges

Corridors of the new Atlanta Merchandise Mart are lined with attractive display rooms. The modular partitions, designed by Shower Door



Company of America, use aluminum extrusions to frame glass and doorways. Sturdy nutplates are provided in the metal door jamb by installing twelve RIVNUTS® fasteners in each door frame.

RIVNUTS® provide several threads so that hinge screws can be fastened securely. These fasteners are ideal for nutplates in thin material. RIVNUTS® are one-piece blind rivets with internal threads. To see if they can help on your fastening problems, please send a print of your part. For bulletin, see Sweet's Product Design File, or write Dept. AE-11, B.F. Goodrich Aerospace and Defense Products, a division of The B.F. Goodrich Company, Akron, Ohio. In Canada: Kitchener, Ontario.



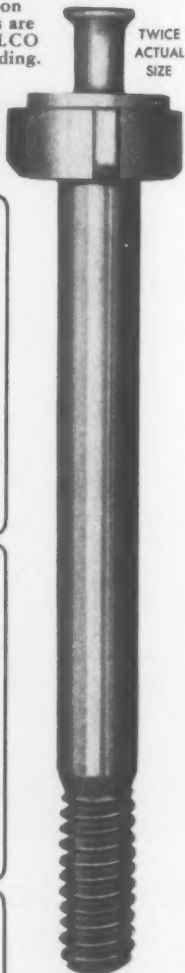
Use postpaid card. Circle No. 251



SPECIAL COLD-HEADED PRODUCTS

Complex shapes made by cold-heading reduce costs of popular products

Critical tolerances on unusual head styles are maintained at ELCO through cold-heading. This large cold-headed piece is made of brass and used in the assembly of the familiar garden-hose nozzle.



TWICE ACTUAL SIZE



ACTUAL SIZE

The special oblong-shaped head on this aluminum machine screw is held to 45° angles on the body for a plastic products manufacturer.



TWICE ACTUAL SIZE

The unusual flat oblong head on this screw enables it to function as a movable shelf holder sliding in matching molding.



ACTUAL SIZE

A manufacturer of cabinet hardware uses this ball-headed wood screw as one functional part of a widely-used door catch.

ELCO also manufactures a complete line of standard wood screws, machine screws, pipe plugs, nuts, and other widely-used fasteners. Need special parts? We are prepared to quote promptly. Simply send blueprints or parts. Write for samples of cold-headed parts we have made.

ELCO TOOL AND SCREW CORPORATION

1101 Samuelson Rd., Rockford, Ill.

Use postpaid card. Circle No. 252

amber. When both parts of the compound are mixed to an even tint, the adhesive is ready for use.

Fully cured metal-to-metal bonds using the adhesive yielded up to 3,500 psi.

Rubber & Asbestos Corp., 225 Belleville Ave., Bloomfield, N. J.

Use postpaid card. Circle No. 59

EXPLOSIVE CARTRIDGES FOR SEPARATION FASTENINGS



A family of standard explosive cartridges provides power to actuate mechanisms such as separation systems, electrical disconnects and other cartridge actuating devices.

The cartridges have design parameters which meet all pertinent military specifications and are environmentally qualified.

Hi-Shear Corporation, 2600 W. 247th St., Torrance, Calif.

Use postpaid card. Circle No. 60

CONNECTOR WITH THREAD ASSIST & LOCK COUPLING

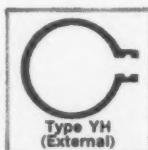


An environmental, electrical connector features advantages of MIL-C-26482 and 26500 with a combination thread assist and ball-lock coupling mechanism. For multiple contact configuration connectors where high mating forces are present, this design utilizes an acme thread assist for ease of coupling, strength and vibration resistance.

Other design features include: crimp type, insertable-removable contacts; high temperature inserts and plating; a specially designed rear support nut for immediate modification to accept end bells, cable clamps, adapters and potting cups; color keyed alignment and lock indicators.

The Deutsch Company, Electronic Components Div., Municipal Airport, Banning, Calif.

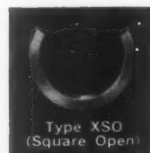
Use postpaid card. Circle No. 61



Type YH (External)



Type WA (Annealed)



Type XSO (Square Open)

...Improve Product Quality!
...Lower Production Costs!

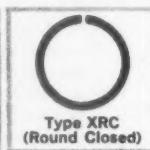
NATIONAL RETAINING RINGS

Call or write for catalog or ask for recommendations on specific applications

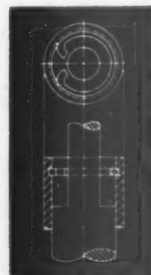
Eliminate machining time and material waste resulting from cutting down shafts and housings to form shoulders. Using smaller shafts, grooved to accommodate economical NATIONAL Retaining Rings, accomplishes important cost reductions, speeds-up production, actually improves the product. Proven applications range from heavy duty machinery to small tools, electronic instruments and toys.



Bar Ring



Type XRC (Round Closed)



Type ZH (Internal)

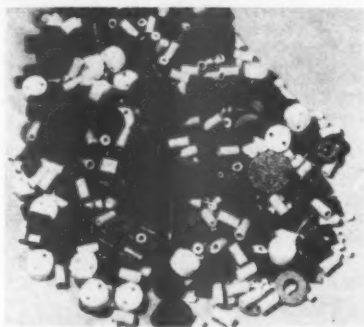
The NATIONAL LOCK WASHER COMPANY
MILWAUKEE 2, WISCONSIN
NEWARK 5, NEW JERSEY

Serving Industry Since 1886

Use postpaid card. Circle No. 253

Assembly & Fastener Engineering

EPOXY PELLETS EASE BONDING APPLICATIONS



Epoxy pellets eliminate the three most serious drawbacks of epoxies; difficulty in mixing, difficulty in metering and skin irritation.

The pellets will bond most similar and dissimilar material. Excellent bonds can be made between metal and glass or plastic; brass to stainless steel and many other "hard to bond" materials. Shear strength of a steel to steel bond is 4700 psi.

Epoxy Products, Inc., 137 Coit St., Irvington, N.J.

Use postpaid card. Circle No. 62

ROSIN-CORE SOLDER GIVES UP TO 33-1/3% MORE SPREAD

A rosin-core solder specially processed from virgin tin and lead provides up to 33-1/3% more spread.

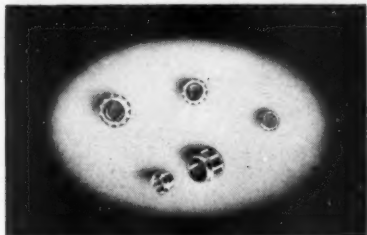
Meeting Federal specifications QQ-S-

571C, the solder consists of a solder wire center core coated with flux. It is then covered with an outer sleeve of solder. It is available in all alloys of tin-lead and may be had in tin-lead-silver for soldering silver-fired ceramic parts.

Alpha Metals, Inc., 56 Water St., Jersey City 4, New Jersey.

Use postpaid card. Circle No. 63

TAPERED LOCK NUT RESISTS THREAD STRIPPING



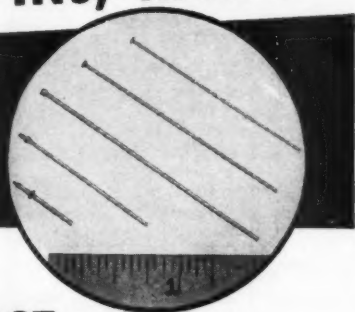
A line of self-locking nuts incorporates two tapered members which rotate together via a key and key-way. The internal, tapered member, which is also internally threaded, moves freely along the taper of the external part. This action produces both a positive friction lock and compression lock.

This method of locking prevents stripping of threads and thread distortion under load, reduces fatigue, and gives a thread contact area under load approaching 100%.

continued

LONG, THIN PINS, RIVETS

COLD HEADED



FAST... ACCURATELY... MORRIS-OMEGA



Special Model "O" OPEN DIE Double Stroke Header, produces long thin parts in diameters from .020" to .090" up to 2 3/4" long at rates up to 100 per minute!

Also available: Solid Die Headers for wire diameters as small as .012".

For Complete details and prices, Write:

REM SALES INCORPORATED
SUBSIDIARY OF THE ROBERT E. MORRIS COMPANY
5010 FARMINGTON AVE., WEST HARTFORD 7, CONN.

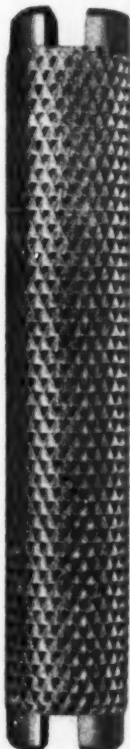
Use postpaid card. Circle No. 254



COLD-HEADED SPECIAL PARTS

Close tolerances can be held on many types of cold-headed parts.

The sharp diamond knurl on this piece serves a functional purpose in a seat belt buckle. Slots in the ends must be parallel and held to .010" tolerance between bottoms of slots (2.025/2.035").



TWICE ACTUAL SIZE



TWICE ACTUAL SIZE

The sharp-cornered hexagon head on this steel machine screw (used as an adjustable stop in a piece of office equipment) is extra long, and the overall length has a tolerance of $\pm .005$ ".



THREE TIMES ACTUAL SIZE

This little heat-treated machine screw has 1 3/64" of 6-40 threads, a special extrusion on the head .02" high, and a conical indent in the tip.



TWICE ACTUAL SIZE

This Type BA tapping screw with its unusually large indented Phillips head is part of the snap fastener for an automobile convertible top.

OTHER ELCO PRODUCTS

TAPPING SCREWS
SEMS
THREAD CUTTING
SMALL SCREWS
MACHINE SCREWS
PIPE PLUGS
MACHINE SCREW NUTS
CAP SCREWS
LAG SCREWS
DRIVE SCREWS
SPIN LOCK
WOOD SCREWS
PHILLIPS HEADS
PEARSON HEADS
CLUTCH HEADS

SEND FOR FREE SAMPLES OF COLD-HEADED PRODUCTS
Need special parts? We are prepared to quote promptly. Simply send blueprints or samples.

ELCO TOOL AND SCREW CORPORATION

1101 Samuelson Rd., Rockford, Ill.

Use postpaid card. Circle No. 255



GRIPCO GUS expands the gang...

Have you met hard workin' GRIPCO GUS? His job is finding the best nut for *your* application—and that naturally includes developing new ones from time to time. His latest brainstorm is a particularly good example of this continuous service. More important, it's a particularly good *nut*. Take a look:

The New GRIPCO® TAB WELD NUT

S1 (Spotweld Type) Single weld area for applications where space is a factor.

S2 (Spotweld Type) Double weld area for maximum strength.

P1 (Pilot Projection Type) Single weld projection.

P2 (Pilot Projection Type) Four weld projections, eliminating rocking during welding operation and to give a maximum weld.

All offerings:

- Self-locating pilots for fast, accurate positioning—no locating devices needed.
- Convenient location of pilots and projections—no retapping required.
- Fast, clean welding—minimum current, short time-cycle.
- High welding quality, low carbon steel construction.
- Optional self-locking feature—the exclusive GRIPCO Toplock.
- Complete range of sizes available for immediate delivery from stock.

Get the full details on the new GRIPCO Tab Weld Nuts—including data on welding set-ups and complete price information—from *your* GRIPCO GUS. You'll find him listed in the Yellow Pages under "Bolts & Nuts" as the local GRIPCO Representative.

*GRIPCO is a registered trademark of Grip Nut Co.

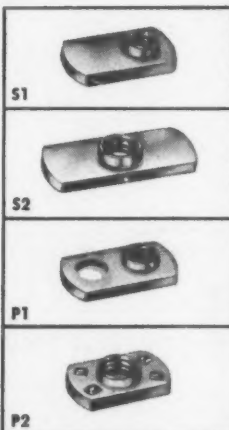


GRIP NUT COMPANY

Subsidiary of Heli-Coil Corporation,
Danbury, Conn.

211 Maple Ave. • South Whitley, Ind. • Phone: South Whitley 723-3111

3136



The Tapand Locknut is available in standard sizes from 1/4" to 3/8".

Tapand, Inc., 49 Oak St., Norwood, New Jersey.

Use postpaid card. Circle No. 64

INSERT ELIMINATES SEIZURE AND GALLING AT 1200°F.

A self-locking insert developed specifically for high-temperature fastening applications up to 1200° F is precision formed to a diamond shape and coiled to provide the thread.

The Screw-Lock insert attains its locking effect from a grip coil midway in its length.

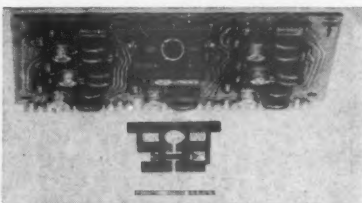
As the bolt is screwed through the threads of the insert, it forces the flat chords of the grip coil to conform to the usual thread shape, while the chords maintain a uniform locking effect on the bolt, even after repeated assembly and disassembly.

When used in equipment that is screw-thread assembled, the insert protects against service abuse, and eliminates seizure and galling.

Heli-Coil Corporation, Shelter Rock Lane, Danbury, Conn.

Use postpaid card. Circle No. 66

TRANSISTOR HEAT SINKS HAVE NATURAL CONVECTION



A series of small, light natural convection transistor heat sinks provide maximum heat dissipation. They were developed to satisfy the needs of the electronic engineer concerned with the reduction of space and weight in the design of component boards for computers.

The Model 2700 series heat sinks substantially increase transistor performance by optimizing the effect of the heat transfer coefficient available in free convection.

Astro Dynamics, Inc., 200 Sixth St., Cambridge, Mass.

Use postpaid card. Circle No. 67

APPLIANCE HINGE ADJUSTS TO DOOR THICKNESS

An adjustable hinge designed for refrigerator door application compensates for irregular door thicknesses. The bright chrome finish hinge permits an "in and out" adjustment.

National Lock Co., Rockford, Ill.

Use postpaid card. Circle No. 68

SOLDERLESS TERMINATOR USED AS PIN CONNECTOR

A solderless wire terminating device is designed to be used as a multi-pin connector, or as a terminal block. All

connections are made by crimping with a hand tool or bench type machine.

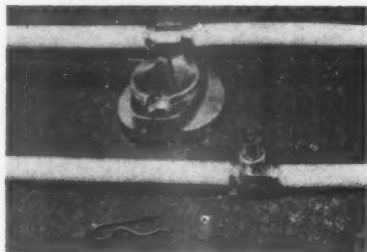
The Connecto-Bloks presently available house up to 300 male pins and are similar in appearance to tree-type solder terminal blocks.

Included in the basic terminal block family are three types for use in audio and control circuits, and one type for video and pulse circuit applications.

The Thomas & Betts Co., 36 Butler St., Elizabeth, N.J.

Use postpaid card. Circle No. 69

FRANGIBLE NUTS USED FOR STATE SEPARATION SYSTEM

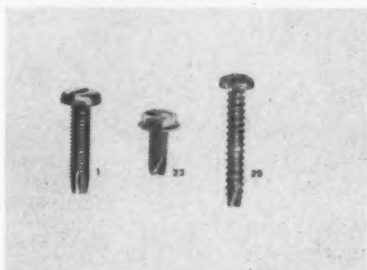


A new separation system for missile stages is based upon the development of a frangible nut and integral dual explosive train. In typical operation, the nuts are torqued to bolts joining two missile stages. They can be installed during production line assembly. The explosive train is connected just prior to launching, giving the assembly a high reliability and safety factor.

Special Devices, Inc., 16830 W. Placerita Canyon Rd., Newhall, Calif.

Use postpaid card. Circle No. 70

THREAD CUTTING SCREWS WITH MIN. DRIVING TORQUE



Thread cutting screws which require a minimum driving torque are now available in Types 1, 23, and 25.

The cutting edge and chip activity in the tapered entering threads allow removal of material to form a close-fitting mating thread.

Southern Screw Co., PO Box 1360, Statesville, N. C.

Use postpaid card. Circle No. 71

ALUMINUM INSERTS USED FOR WOOD PRODUCTS

An aluminum threaded insert is designed for use in blind or through hole applications in wood products.

The Flo-Lock Bushing has an external fin at its base, around which the wood fibers flow during installation. An axial knurl provides resistance against bushing rotation during screw installation.

Heli-Coil Corp., Danbury, Conn.

Use postpaid card. Circle No. 72

NEW... "Low Cost" PRUTTON PLANETARY THREAD ROLLING MACHINE for Short Runs and Special Runs



- FAST SET-UP TIME
- LOW DIE COST—USES NEW STYLE SMALL PLANETARY DIES

Now, for the first time in the history of thread rolling, short runs and special runs can also be produced economically on a planetary machine—the small, new Prutton, Model 75A-24.

This low cost machine uses small new style Prutton Planetary Dies—rolls class 3 fit. Fast set-up time—change to different thread lengths in only 30 seconds. No shims needed for easy die matching. Simple mechanical type uninterrupted feed. All working parts visible and easily accessible. Large 24" hopper holds 50 lbs.

SPECIFICATIONS

Capacity	No. 4 screws to 1/4"
Thread length	up to 2"
Overall blank length	3"
Production speed	400 ppm.

An excellent extra machine for economical, dependable, fast production—keep your large Prutton machines busy on big production of long runs. Send us prints and/or samples of your part for exact machine cost.

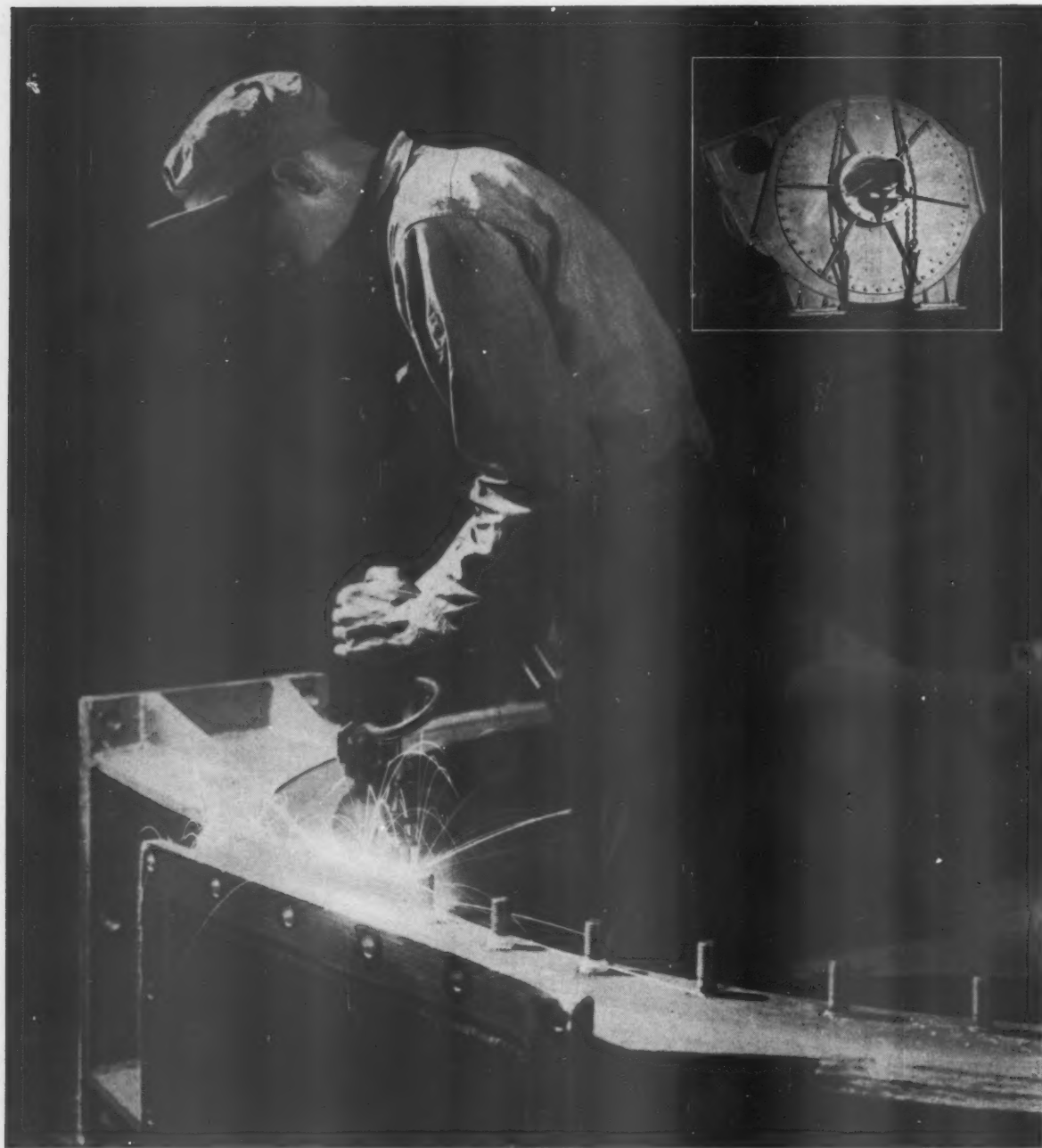


PRUTTON CORPORATION

Leader in Planetary Thread Rolling Machines

5305 WEST 130th STREET CLEVELAND 30, OHIO

Use postpaid card. Circle No. 257



FASTENING TIME CUT 80% WITH NELSON® STUD WELDING

Bearing plates for these 9-ton coal pulverizer exhaust casings are fastened 80% faster with Nelson Stud Welding...and expensive material handling is eliminated. Threaded studs, $\frac{7}{8}$ " in diameter, are end-welded at a rate of 4 to 5 per minute. That's real speed—especially when compared to the 2 to 4 minutes each it takes to drill, tap and set threaded stud bolts. It's easy to see how Nelson Stud Welding cuts costs, increases production. With stud welding, all the work is done on one side—without warping or damage. Heavy bosses are not needed since there's no need to provide tap depth. And because there are no

holes in the base material, there is no possibility of leaks in water and oil-tight units. Take the tool to the work... get greater design flexibility and lower material handling costs. Nelson studs are available in diameters from $\frac{1}{4}$ " to 1" for all types of applications. For application ideas, design recommendations and full method information, send for the Nelson "Design Manual". **NELSON STUD WELDING**, Division of Gregory Industries, Inc., Department AF, Lorain, Ohio.



Use postpaid card. Circle No. 258

Assembly & Fastener Engineering

USEFUL LITERATURE

To receive your copy of any literature reviewed here, use the postpaid card opposite page 68.

AUTOMATIC ASSEMBLY UNITS

A twenty-page bulletin on multi-station automatic assembling and processing machines illustrates complete automation units, both standard and special models, and indexing machine chassis made in stock models. The description covers standard machines for performing operations in the manufacture of incandescent and fluorescent lamps and also special machines for processing such diverse products as electronic parts, military fuses, and typewriter components. Swanson-Erie Corp., 814 E. 8th St., Erie, Pa.

Use postpaid card. Circle No. 90

AUDIO VISUAL INSTRUCTION

An audio-visual instruction system is described in information sheet. Showing how the unit can be used for assembly lines, other uses include audio-visual instructions for field installation and repair of complex equipment, sales training, teaching new procedures and on-the-job training. Graflex Inc., Rochester 3, N.Y.

Use postpaid card. Circle No. 91

TRANSFER PRESSES

Four representative models of a multiple transfer press line are described in a folder. Data on rated capacity, in tons, production speed capability and a listing of typical applications is offered on each machine. The Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.

Use postpaid card. Circle No. 92

FASTENERS FOR AVIONIC USE

Aerospace Catalog No. 960 is a 64 page design manual which focuses attention on reduced dimension, lightweight types of self-locking fasteners. Its purpose is to provide the design engineer with a concentrated package of nut shapes covering complete lines

of miniature hex, anchor and clinch types which experience has shown to be useful in the assembly of units intended for avionic and electronic end use. Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.

Use postpaid card. Circle No. 93

PORTABLE SPOT WELDER

A portable, resistance type spot welder with a built-in timer is described in information folder. Complete information of the available accessories, and features of the welder are included. Also included are a description of possible uses. Ace-Sycamore, Inc., Associate of Holub Industries, Sycamore, Illinois.

Use postpaid card. Circle No. 94

PRE-ENGINEERED ASSEMBLY LINES

A pre-engineered assembly line method is based on a system of modular units. Each component of the system is integrated, containing all the basic elements necessary for efficient assembly of products. The system is particularly suited to short run assemblies and product mix assemblies. Kaytrim Systems, Division of Four Seasons, 2 Pelham Rd., New Rochelle, New York.

Use postpaid card. Circle No. 95

AREA LIGHTING DESIGN

Bulletin GEA-7223, 30 pages, describes complete area lighting with eight new products. It includes an equipment quick selector, sample lighting layouts, description of typical area lighting applications, with photographs, layouts and equipment recommendations. The bulletin also includes product data, with structural features and electrical characteristics of incandescent, mercury and fluorescent fixtures. General Electric Co., Schenectady 5, N.Y.

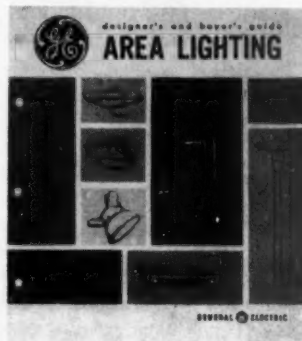
Use postpaid card. Circle No. 96



See No. 94



See No. 95



See No. 96

SEALED PRECISION BEARINGS

Information on performance, dimensions, size and design characteristics of the "Flexal" bearing is contained in data sheet F-1. The precision sealed bearing retains its lubricant while operating at high speeds in moderate to high temperatures. The Barden Corp., 200 Park Ave., Danbury, Conn.

Use postpaid card. Circle No. 97

REVISED BELT STANDARDS

Dimensions and recommended procedures for integral-horsepower V-belt drives used primarily for power transmission in industrial applications requiring one or more V-belts are provided in a newly approved American Standard for multiple V-belt drives. "American Standard Specifications for Multiple V-Belt Drives, B55.1-1961" is available from the American Standards Association, Dept. P 240, 10 E. 40th St., New York 16, N.Y. The standards are priced at \$2.00 a copy.

Use postpaid card. Circle No. 98

WIRE & RIBBON CUTTER

A wire and ribbon cutter kit is designed as an accessory compatible with welding equipment. It may be used for a variety of miniature packaging applications. Catalog WE-11 describes and provides specifications for the tools included. Sippican Corporation, Box 537, Marion, Mass.

Use postpaid card. Circle No. 99

MINIATURE POWER TOOLS

A catalog of miniature power tools and handpieces describes four basic miniature power tools. The catalog, No. 210A, also covers accessories, speed controls and a buffing and grinding motor. Foredom Electric Co., Inc., Bethel, Conn.

Use postpaid card. Circle No. 100



O-RING APPLICATIONS

The development of a technique for manufacture of o-rings to military specifications is described in eight-page brochure. Ample illustrated, the brochure describes production and present uses of the o-ring. Parker Seal Co. Div. of Parker-Hannifin Corp., 10567 Jefferson Blvd., Culver City, Calif.

Use postpaid card. Circle No. 101

LEAK DETECTORS

Leak detectors for inspection of welds, seams, joints and other suspected areas of leakage in pressure systems are described in eight page bulletin GEA-6817-A. Also described is the helium-sensitive mass spectrometer leak de-

tor, Type M-60, used for ultra-sensitive applications in the electronics, nuclear, aircraft and missile industries. General Electric Co., Schenectady 5, New York.

Use postpaid card. Circle No. 102

HEX HEAD CAP SCREWS

The advantages to users of hex head cap screws are the subject of a brochure, 2788. The literature compares performance of the hex head cap screw, made to strict ASA Standard B-18.6.2 with other fastenings. Specific design features of the cap screw also are described and illustrated in the brochure. Cleveland Cap Screw Co., 4444 Lee Rd., Cleveland 28, Ohio.

Use postpaid card. Circle No. 103

COATED STEELS

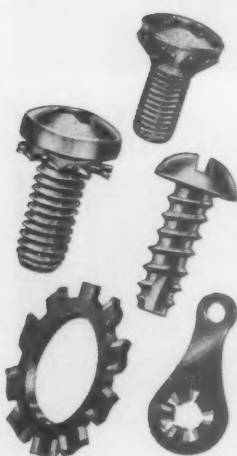
An illustrated brochure on the wide industrial applications of coated strip steel presents the entire Sharon family of coated steels—including galvanite, bright zinc, special alloy coat, electro-galvanized and painted and printed steel. The booklet is designed to help the user select the proper coated steel for his product. It details size ranges, welding, soldering, cleaning, chemical treatment, temper classifications and Preece tests.

Sharon Steel Corp., Arthur Schmidt & Associates, 342 Madison Ave., New York 17, N.Y.

Use postpaid card. Circle No. 104



Need a fast solution to a fastener problem?



YOU GET INDIVIDUALIZED SERVICE FROM THOMPSON-BREMER

We are one of the few fully integrated manufacturers of Sems, lock washers, thread-cutting screws, terminals and cold-headed specialties. Since our engineering services and components manufacturing are together under one roof, we are particularly well able to give you fast, individualized service at competitive prices. We'll bid on your specials requirements, or fill orders for standard items on short notice from the extensive line of EVERLOCK products stocked by your local distributor. Send for catalog and samples or call your EVERLOCK representative.

Use postpaid card. Circle No. 259



INDUSTRIAL FASTENERS

Thompson-Bremer & Co.
Division of
American Machine
& Foundry Company

Thompson-Bremer & Co.
Dept. 6129
228 N. LaSalle St.,
Chicago 1, Ill.

Please send me _____ EVERLOCK fastener catalogs and _____ sample sets of EVERLOCK industrial fasteners and cold-headed specialties.

Name _____ Title _____

Company _____

Street _____

City _____ Zone _____ State _____

QUARTER TURN FASTENERS

Complete line of variety of quarter turn fasteners is listed in catalog D-3. Included are engineering drawings, charts and tables of sizes available, and typical uses. Dzus Fastener Company, Inc., West Islip, N.Y.

Use postpaid card. Circle No. 105

SCREW MACHINE TOOLS

New brochure describes complete line of standard screw machine tools. Data includes specifications and prices covering: centering tools, revolving stops, and slotting bushings and adapters. Mueller Industries, 510 E. Rand Rd., Mt. Prospect, Ill.

Use postpaid card. Circle No. 106

WIRE CONNECTORS

Five sizes of porcelain wire connectors are described in information sheet. The connectors described are for stranded and solid wire, and two sizes are for high voltage connections. Holub Industries, Inc., Sycamore, Ill.

Use postpaid card. Circle No. 107

AIR PRESSES

Bulletin 0960-B1 gives complete dimensioning and technical information for all open gap and column air presses in both bench and floor mounting models. Thirty-four press sizes are offered in a broad choice of capacities from as little as 1/2 ton to 50 ton force at 80 psi air line pressure. The power presses are used for assembly, riveting, forming, bending and molding applications. Hannifin Co., Dept. 416, 501 S. Wolf Rd., Des Plaines, Ill.

Use postpaid card. Circle No. 108



BERYLLIUM BOLT HISTORY

A review of the development of the first beryllium structural bolting is contained in 16-page reference booklet. The review provides more than just a rundown of the high strength-weight ratio beryllium shear bolts. Starting with the year 50 AD, an easily digested review of the history of beryllium to date is given. Standard Pressed Steel Co., Box 1121, Jenkintown, Pa.

Use postpaid card. Circle No. 109

CONTACT ADHESIVE

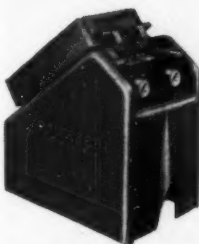
New bulletin describes contact adhesive for bonding plastic laminates, wood, paper and metals. Features include fast tack, long open time and high coverage. St. Clair Rubber Co., 107 Clifford, Detroit 26, Mich.

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Answer to problem on page 56, A 1, 3, 9, 27, and 81 pound weight will do the job.



Cuts Assembly Time in Half



NEW Powasert feeder with continuous raceway, smooth-action feeder tray.

The Powasert Automatic Screwdriver speeds up any assembly operation that uses wood, sheet metal or machine screws. Just select the screw you want, fill the feeder and you're ready for work. No need to handle screws.

To operate, press Powasert to the work surface and squeeze the trigger. Air powered, Powasert automatically feeds and drives up to 60 screws a minute. In many applications you can even eliminate pre-drilling.

Safety engineered, Powasert eliminates gouging, driver slipping and stripped heads. Screws are driven home tightly and flush with the surface every time.

Learn how Powasert can cut your assembly time in half, save labor, reduce rejects and improve profits. For complete details, write to Powasert, United Shoe Machinery Corporation, Boston 11, Mass.

United
POWASERT®

The Automatic Way to Fastening Speed and Savings

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PORTABLE TENSILE TESTER

Laboratory accuracy and production inspection swiftness are combined in two tensile testers described in bulletin 750-P. The brochure gives complete specifications for the Model TT testers, which are specially designed for testing the breaking strength of electrical leads, terminal and connectors, and the Model TJ tester which is equipped with automatic jaw pairs for tensile testing many small parts or material samples as well as electrical leads and connections. Hunter Spring Co., Div. of American Machine & Metals, Inc., Lansdale, Pa.

Use postpaid card. Circle No. 111

AUDIO-VISUAL ASSEMBLY

Booklet details advantages of audio-visual assembly, and gives case histories of how new employee's learning time was cut 75%, production increased 50% and rejects reduced 55%. It also tells how audio-visual can be of immediate help in other areas beside assembly. Videosonic Systems, Hughes Ground Systems Group, Building 381-L, Fullerton, California.

Use postpaid card. Circle No. 112

TOLERANCE RINGS

Tolerance rings made in inch and metric dimensions both in AN and BN types are listed in 27-page catalog. Also included are engineering drawings, and charts showing the parameters of per-

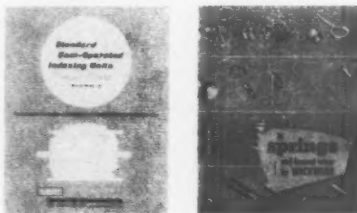
formance of the rings. Roller Bearing Co. of America, Sullivan Way, West Trenton, N. J.

Use postpaid card. Circle No. 113

CAM INDEXING UNITS

Bulletin No. 26, a 16-page engineering specification bulletin, contains complete information on the two model ST-A9AB indexing units. It contains information on available indexing cams and dial plates, on machine bases, motors and electric timers. A comprehensive rating table and load calculation method are included as well as a nomogram for "Weight and Moment of Inertia" calculations and a torque rating table. Standard Tool & Manufacturing Co., 738 Schuyler Ave., Lyndhurst, N.J.

Use postpaid card. Circle No. 114



SPRING DESIGN

A glossary of spring terms is one of the sections in a 42-page spring catalog. Included in the catalog are engineering graphs on spring stresses, physical properties, tensile strengths

and spring design. Wire tables for spring design and helical torsion spring design are also given. Wickwire Spencer Steel Div. Colorado Fuel and Iron Corp., P.O. Box 551, Palmer, Mass.

Use postpaid card. Circle No. 115

HINGED-STEEL BELTING

Complete engineering specifications are given for hinged-steel belting used in material handling conveyors. Bulletin MF-600-A, a six page folder, gives complete description of the belting, and shows photog.aphs of the equipment in installed operations. May-Fran Manufacturing Co., 1710 Clarkstone Rd., Cleveland 12, Ohio.

Use postpaid card. Circle No. 116

METAL CABLE CLAMPS

Catalog sheet gives prices and available sizes of the AL and NE type cable clamps. The neoprene coating on the NE type clamps has a high coefficient of friction and grips a rubber or plastic jacketed cable or cord with a positive grip. Richco Plastic Co., 3722 W. North Ave., Chicago 47, Ill.

Use postpaid card. Circle No. 117

BRAZING ALLOY CHART

A brazing alloy reference chart lists metal compositions, density, and melt and flow temperatures for silver brazing alloys and precious metal brazing alloys. The chart details 37 compositions, in-

AT RAYTHEON:

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New, non-corrosive, easily cleaned... stack and restack securely in tight semi-circular arrangement to suit changing requirements... molded card holders on fronts for fast, easy parts identification... sloping bottom for easy parts accessibility.

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SCREWS-NUTS
WASHERS
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**-WITH MATCHING
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For accurate use in

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Assembly & Fastener Engineering

cluding all commercially important silver base alloys and many special purpose compositions. The 19 precious metal compositions listed are ideal for atmosphere brazing and provide the higher brazing temperatures required for vacuum tube, aircraft and missile use. Technical Service Dept., Engelhard Industries, Inc., 75 Austin St., Newark 2, New Jersey.

Use postpaid card. Circle No. 118

INDUSTRIAL DRILL SETS

Folder covers high speed steel drill sets for general purpose industrial applications. Included are brief descriptions of ten convenient drill sets ranging from the pack of 1/4" shank drills to a set of 60 drills in wire gage sizes from one through sixty. Specifications are also given on the 1/2" shank drills, 12" and 18" long drills as well as carbide-tipped masonry drills. Ace Drill Corp., Adrian, Mich.

Use postpaid card. Circle No. 119

ELECTRIC WELDING LIBRARY

Technical papers on electric welding include process and application details on short arc welding, mig and tig welding and spot welding, submerged arc welding, plasma arc welding and weld surfacing. These papers have been presented at meetings of technical societies and published in industrial journals. Linde Co., Div. of Union Carbide Corp., 270 Park Ave., New York 17, N.Y.

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An opportunity to increase your sales. Well-established Manufacturers' Agents covering Ohio area from two offices have the time and ability to sell one additional fastener or associated item. Presently selling all major O.E.M., jobber and distributor accounts, including automotive replacement parts market. Will happily pioneer your product if you can show potential.

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**12 POINT EXTERNAL
WRENCHING BOLTS**
certified aircraft quality



Mercury 12 point external wrenching bolts, manufactured from high tensile steel and high temperature, heat resistant materials, to meet exacting customer requirements. High temperature... MS 9033 thru MS 9039; High tensile steel... MS 9088 thru MS 9152. Exotic materials available.

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November, 1961



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FROM WIRE STOCK

- No lead time needed for dies or exact strip.
- Use with induction, gas-air, furnace, or other heating methods.
- Available in EASY FLO and SILFOS — Copper, Bronze, and other alloys.
- Diameters up to 4" I.D., wire thicknesses from .010 upward.

Write for 16 page booklet on better brazing.

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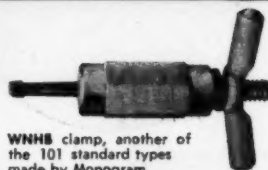
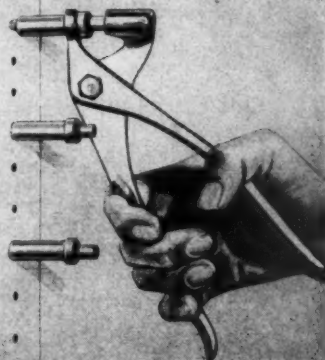
5060 South Lake Drive, Cudahy, Wisconsin

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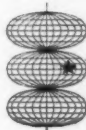
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*...better, faster, at lowest cost
with Monogram Kleko Clamps*

Stop wasting time and money with less efficient temporary fasteners and start solving all your sheet metal holding problems using MONOGRAM Kleko clamps and affixing tools. Write, wire, phone now for information on our 101 precision-engineered standard clamps for practically every temporary holding need during fabrication. And, if we don't carry the clamp you call for, we can make it faster, better to highest specifications.



WNH clamp, another of the 101 standard types made by Monogram.



MONOGRAM Precision Industries, Inc.
8557 Higuera Street, Culver City, Calif., UP 0-6531

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DRILL PRESS VISE

Brochure RX45, catalog sheet No. 738, provides essential information on both the milling machine vise and a push-pull, rapid action drill press vise. Exact specifications are given for each vise. Wilton Tool Manufacturing Co., Inc., 9525 Irving Park Rd., Schiller Park, Ill.

Use postpaid card. Circle No. 121

RETAINING RING CATALOG

Complete information on the entire company line of retaining rings is covered in 24-page catalog No. 61. It includes dimension tables, engineering specifications and mechanical drawings, as well as information on prestacked

rings in the 3000, 3100, 4000 and 4100 industrial series. Industrial Retaining Ring Co., 57 Cordier St., Irvington 11, New Jersey.

Use postpaid card. Circle No. 122

FLOATING CLIP NUT

Installation and engineering specifications for floating clip nut are given in four page bulletin. The nut offers advantages for use in secondary structure and non-structural attachments, and reduces the time and work involved in preparing sub-assemblies for installation. Elastic Stop Nut Corporation of America, 2330 Vauxhall Rd., Union, N.J.

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SPECIFICATIONS -
From the Hand of the
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ERIE

Bolts • Studs • Cap Screws • Nuts
in Alloys • Stainless • Carbon • Bronze



Experienced hands . . . expert hands . . . hands grown competent by 45 years of the finest precision work. These are the hands of our specialists who meet your design and engineering specifications. Special Erie fasteners to meet the rigors of extreme temperatures, corrosion, tensile stresses are serving widely diverse industries the world over. Send your specifications to us, confident of the finished precision fasteners you expect.

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Representatives in Principal Cities

INDUSTRIAL FASTENER DATA

An eight-page, condensed bulletin No. 2449 describes complete line of standard precision industrial fasteners—including socket screw products, pressure plugs, locknuts, spring pins, dowel pins and steel collars. The bulletin details basic data on types, sizes, threads and plating, gives design features and application information as well. A. Roesler, Box 1229, Standard Pressed Steel, Jenkintown, Pa.

Use postpaid card. Circle No. 124

CONSTANT-FORCE SPRINGS

A complete description of each of twenty-one standard constant-force extension springs is given in a data sheet A-310X. Previously available only in designs for specific applications, the new standard springs are intended primarily as an experimental tool for the design engineer. The data sheet gives complete technical information about each of the stock springs. It includes such data as material thickness, width, length, working deflection, load and life. Complete price and ordering information are also given. Hunter Spring Co., Div. of American Machine & Metals, Inc., Lansdale, Pa.

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MULTIPLE CONNECTORS

A six-page folder describes three separate lines of multiple connectors, with specific data sheets for each of the lines. The data sheets give complete specifications on contact sizes and materials, wire crimp and insulation support, wire and insulation size ranges, receptacles and housings. Also described is the compression-crimp technique, and tooling, both hand and automatic for attaching terminals to circuit leads and for stripping wire preparatory to crimping. AMP Incorporated, Eisenhower Blvd., Harrisburg, Pa.

Use postpaid card. Circle No. 126

AIR COMPRESSOR CATALOG

A 16-page catalog, covering its complete line of air compressors for automotive, industrial and contractor applications includes data on more than 200 models. Lincoln Engineering Co., 4010 Goodfellow Blvd., St. Louis 20, Mo.

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SOLDER PREFORMS

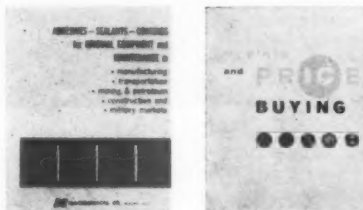
Solder preforms are described in four page brochure. Also described is packaging of solder rings, stampings and discs. Kester Solder Co., 4201 Wrightwood Ave., Chicago 39, Ill.

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SEALANTS & ADHESIVES

An eight-page catalog lists properties, applications and various industrial uses of chemical coatings, sealants and adhesives. It covers over eight products in detail, with examples of new uses for many of the items in such fields as automotive manufacture, marine and boatbuilding, military and aerospace uses and all types of manufacturing and industrial processes. Industrial Research Laboratory, Magichemical Co., Brockton, Mass.

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INSTALLED EYELET COST

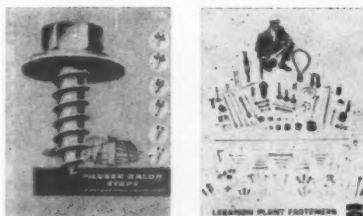
Four-page bulletin offers details of the advantage of using eyelets for cutting the installed costs of assembly. Of interest to eyelet users is the section devoted to the system of standardized eyelet sizes and how seven sets of tools are needed for all 65 sizes. United Shoe Machinery Corp., Fastener Division, Shelton, Conn.

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SCREWS WITH NYLON WASHERS

Design, function and applications of three types of fasteners used in building construction are described and illustrated in four-page bulletin No. 3C. It describes the standard tapping screws preassembled with nylon or neoprene washers, for effective control of leaks, squeaks, crazing and electrolysis in all types of metal structures and assemblies. Parker-Kalon, Div. of General American Transport Corp., Clifton, N.J.

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FASTENER MANUFACTURE

Compiled with many full-color photographs, 25-page booklet 556 gives a history of company's plant, describes its modern manufacturing facilities, and details many of its important products and processes. A two-page flow chart outlines the manufacture of a fastener, from steel billet to bolt. Bethlehem Steel Co., Bethlehem, Pa.

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MACHINE
SCREW

CAP

PANEL/
SWITCH

MINIATURE

SPECIAL

SEMI-FINISHED

10183-75

Booster shot...

FOR "TIRED" ASSEMBLY AND FASTENING OPERATIONS

When production schedules sag and assembly problems give you a persistent headache . . . it's time to turn to Fischer for precision turned brass and aluminum nuts. Fischer produces standards, specials and miniatures in O.D. sizes from $\frac{1}{8}$ " to $1\frac{1}{2}$ " . . . with tolerances on lengths and diameters held to $+.000$ " and $-.005$ " . . . combined with special thread diameters from No. "0" to $\frac{3}{4}$ ". The nuts pictured at left illustrate the wide range of Fischer's capabilities. Regardless of your requirements, you can depend on Fischer for premium quality nuts at competitive prices.



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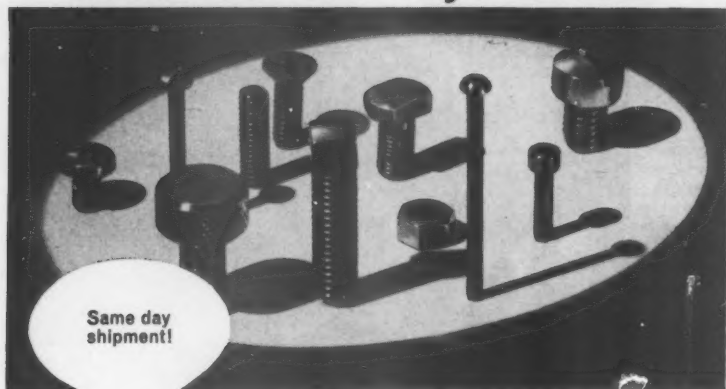
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Same day shipment!



Thousands of standard fasteners in stock!

Every order is backed by over 35 years of specialized experience in manufacturing the exact needs of users in nearly every field! Whether it's a complicated special, or stock standard, Anti-Corrosive can provide prompt delivery at competitive prices. Send us your specifications for quotations and engineering counsel—for immediate action! Write for complete literature.

From "nails to thingamajigs"—if we don't have it IN STOCK, we can make it for you! Draw from our vast stock of stainless steel fastenings. We also maintain over 400 sizes of Nylo-Fast Nylon Fasteners for immediate delivery. Write, wire, or phone.

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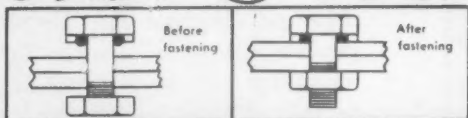
METAL PRODUCTS COMPANY, Inc.

CASTLETON-ON-HUDSON 10, NEW YORK

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For safe, sure sealing of fasteners

Stat-O-Seal®



SELF CENTERING **ONE-PIECE EASY ASSEMBLY** **NO-LEAKAGE SEALING**

Stat-O-Seals offer superior features for sealing fasteners. The seal is under controlled confinement with full metal to metal contact to assure a positive, no-leakage seal at low or high pressures or vacuum. They are self-centering, provide a high re-usability factor, give longer service. Single, one-piece configuration provides fool-proof assembly, and quick, visual installation inspection; are economical in first cost as well as obtaining savings in safety and ease of installation.

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Culver City, California and Cleveland, Ohio
A DIVISION OF PARKER-HANNIFIN CORPORATION

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New ARMSTRONG "90" SERIES RATCHET

The ONLY Ratchet with ALL these important features!



All wearable parts are replaceable; individually, inexpensively, easily. With no teeth cut into handle, it need never be replaced. *ARMSTRONG on these ratchets guarantees: advanced design, top quality and tool sense.

Extra heavy duty "50" Series ARMSTRONG ratchets (see right) in 1", 1 1/4", 1 1/2" and 2" square drive sizes. Our General Catalog 100, gives complete information on these and approximately 3500 other ARMSTRONG tools. Your local ARMSTRONG Distributor will supply you a Catalog and demonstrate the new ratchets. If you don't know who he is, write us for his name.



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8203 W. ARMSTRONG AVE. CHICAGO 46, ILLINOIS

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Assembly & Fastener Engineering

INDUSTRY MAKES NEWS

AUGUST FASTENER SHIPMENTS

August shipments of industrial fasteners were 95% of the 1956-58 average, according to the Industrial Fastener Institute. August shipments were 1% above July, and marks the fourth consecutive month with an upward trend.

SEMINAR DISCUSSES ASSEMBLY LINES

In a series of seminars held this summer by the Armour Research Foundation, Chicago, a new method for balancing assembly lines was introduced. The system, which can be used for practically all types of assembly lines, can be placed in operation by plant engineers and industrial engineers.

Addressing a group of manufacturing representatives, Dr. Maurice D. Kilbridge of Armour Research stated that many of today's progressive assembly lines waste from 10 to 25% of the worker's time.

Key factor in any progressive assembly line hinges on the nature of the work. In the new system, all that is required in order to balance the line are simple mathematical calculations, regardless of the complexity of assembly.

The system is based on the average cycle time required for each sub-assembly, charted in the order of precedence, and the work is then divided as equally as possible among the number of workers on the line.

TELEWISE AIR FORCE WEAPONS CAPABILITY

Via a special television network, the Air Defense Command of the U.S. Air Force will engage in tests on its capabilities to turn back an attack on America.

From Tyndall AFB near Panama City, Fla., the Air Force World Wide Weapons Meet will be televised beginning October 23. The Air Defense Command sponsors the all-out competition of the nation's top-interceptor and fighter pilots to demonstrate the latest aircraft and air defense tactics.

The entire meet, including night interceptor competition, will be televised to judges, military observers, visitors, and near-by communities. Special tv equipment made at the Dage Division of Thompson-Ramo-Wooldridge will permit camera work at Mach-2 speeds.

The night television coverage is possible because of a new, all-transistorized, light-sensitive tv system. The camera will televise action at light levels below that of stars and jet exhausts of the planes and drones.

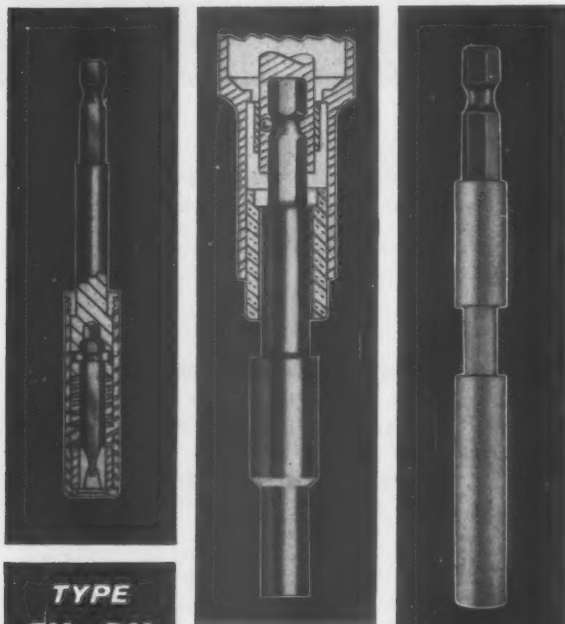


Dr. Maurice D. Kilbridge (l), Armour Research Foundation consultant, explains method of balancing assembly lines to W. B. Scott, vp-manufacturing, Motorola, Inc., and D. W. Thomas, manager-industrial engineering, Ford Motor Co., as Dr. Leon Wester, Foundation researcher (r) looks on. Kilbridge and Wester developed the system which was introduced to the nation's top industries at Foundation sponsored seminars on assembly line problems.



U. S. Air Force personnel handle all narration and camera work during the two-week special telecast of fighter-interceptor tactics at the World Wide Weapons Meet, Tyndall, AFB.

DRIVE SLOTTED HEAD SCREWS FASTER FOR LESS



**TYPE
EH & RH
MAGNETIC
EXTENSION
FINDERS**

EH & RH type Magnetic Extension Finder $\frac{1}{4}$ " and $\frac{3}{8}$ " Hex Drive.

**"C" TYPE
MAGNETIC
BIT HOLDER**

"C" type Magnetic Bit Hold with Finder sleeve $\frac{1}{4}$ " Hex Drive.

**ZN
BIT AND FINDER
SLEEVE**

Standard Extension Finder — not magnetic $\frac{1}{4}$ " $\frac{3}{8}$ " Hex Drive.

FOR USE WITH POWER SCREW DRIVERS

Interchangeable bits and finder sleeves make these tools readily adaptable for a wide range of slotted screw driving applications. Bits and finders are easily and quickly changed on c and zn types.

Several different sizes of screws can be driven by simply changing the bits and finders. All run with Magna Bushings.

Strong permanent magnet holds screws firmly, eliminates hand starting.

In stock for immediate shipment are magnetized Power Screw Driver Accessories that will speed up your Assembly operations work in your assembly department.

Call on us for any special application. We'll work it out for you.

A Complete Line of MAGNETIC
BIT HOLDERS • FINDERS • SOCKETS

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CORPORATION
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BUFFALO 3, N. Y.

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Weighing about 12 lbs., it has power needs less than 100 w., and will provide usable pictures at light levels down to .01 fc. This light level is 100 times less than that needed for ordinary tv cameras.

SIGMUND WALDES PASSES AWAY

Sigmund Waldes, president and chairman of the board of directors of Waldes Kohinoor, Inc., and a partner in affiliated Waldes companies in England and Spain passed away in a New York hospital at the age of 83. He had been ill for approximately two months.

A partner in the firm founded by his brother Henry, he supervised the activities of the Dresden, Germany factory from 1908 to 1938. Forced to leave Germany in that year, he came to this country. In 1941, following his brother's death, he became president and chairman of the board of directors of the Long Island Co. He became an American citizen in 1946.

Dr. Oswald Kolbert, technical director of the Waldes Company also passed away, following a heart attack. A native of Czechoslovakia, he came to the U.S. in 1940 and joined the Waldes company in 1941. He became technical director in 1946.

Kolbert was the author of "The Design and Application of Retaining Rings," which appeared in the May 1960 issue of ASSEMBLY & FASTENER ENGINEERING.



WALDES

FAIRCO ACQUIRES ESNA'S AIRCRAFT DIV.

A joint venture arrangement has been reached by Elastic Stop Nut Corp. of America and Fairco Industries, Inc., whereby the assets and facilities of the Aircraft Bolt Co. division of ESNA will be merged into Fairco. The new company will be known as ABC-Fairco, Inc. Gilbert F. Roswell will be president and chief executive officer.

SHELTON "ODD BALL" RIVETS



Whatever your rivet requirements, ask us to help solve them and discover Shelton Quality is born of experience, the result of high intention, sincere effort, intelligent direction and skillful execution.

We always follow through with helpful service. Invite us to discuss your needs by circling Reader Service card. Our large catalogue and other information will be sent you immediately.

THE SHELTON TUBULAR RIVET CO., Shelton, Conn.

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Assembly & Fastener Engineering

Terms of the agreement also permits ESNA's fastener division sales organization to undertake distribution of the ABC-Fairco bolts. The new company will become a licensee of ESNA for the "Esnathred" process of producing bolts.

SAE SHOW TO HAVE PAN-AMERICAN DAY

A special Pan-American day program will be a feature of the 1962 SAE Automotive Engineering Congress and Exposition.

The special program is being arranged and sponsored by the SAE International Information Committee. The congress sessions are designed to promote an exchange of engineering information between SAE members in the U.S. and South America.

The SAE congress and exposition will be held January 8 to 12, in Detroit's Cobo Hall. Pan-American day is scheduled for January 11th.

GRIES APPOINTS NEW ENGLAND REP.

The Schutter-Young Co., Beverly, Mass. has been named Gries Reproducer Corporation's sales representative in the New England area, covering the OEM market. The company will represent Gries in eastern Massachusetts, and the states of Maine, New Hampshire, Vermont and Rhode Island.

The principals of the Schutter-Young Co. are Robert G. Young and George M. Schutter.

PROMOTIONS AT STANDARD PRESSED STEEL

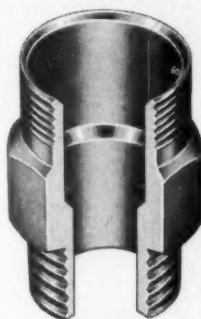
Standard Pressed Steel Co. has announced the following promotions:

Burton W. Van Dyke has been named to the new post of manager of manufacturing. He joined SPS in 1949 as plant engineer. Earlier this year he was named manufacturing manager of fastener products.

Fred C. Gartling has been promoted to manager of

COLD IMPACT EXTRUSIONS

In steel, brass, aluminum and stainless steel



High speed automatic equipment, designed and built by Jacobson, for cold impacting and secondary operations, has resulted in substantial economies in high production items.

Impacted Fitting • 67% saving

JACOBSON NUT MFG. CORP.

Kenilworth, New Jersey

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If you have to
**SECURE IT...
RELEASE IT**

Instantly!



AVDEL
POSITIVE LOCKING • QUICK RELEASE
BALL-LOK PINS

Many Double Acting, Single Acting Pins in several head styles, and Detent Pins are available from stock for quick delivery. Special Pins can be engineered to fit the most exotic applications.

...the self-contained, positive-locking fasteners for fast, secure assembly and quick disassembly.

No nuts or cotter keys to bother with. Simply insert the Avdel pin, release the button... it holds securely until you release it. Ideal for blind or difficult access areas.

Available in several head styles, in sizes $\frac{1}{8}$ " to 3" diameters with grip lengths from 1" to 10 inches. Available in alloy steel and stainless steel. Manufactured to NAS Standards.

Write for application literature

AVDEL

210 SO. VICTORY BLVD., BURBANK, CALIF.
TORONTO, CANADA • HERTS, ENGLAND • GENEVA, SWITZERLAND

Use postpaid card. Circle No. 272

November, 1961

 CONDUIT LOCKNUTS — Up to 6"	 WELD NUTS Square & Hexagon	 MACHINE SCREW & FINISHED NUTS
 STOP-NUTS	 WING NUTS	 SPRING-NUTS
 BARREL-PRONG NUTS	 LOCKNUTS Reversible — One Piece	 SWITCH MOUNTING NUTS
 WASHERED LOCKNUTS	 LOCKNUTS Deflected Top	 IMPACT EXTRUSIONS

Available in Stainless Steel, Brass, Aluminum and Steel
JACOBSON NUT MFG. CORP.
KENILWORTH, N.J.

Use postpaid card. Circle No. 274

IMPORTANT NEWS FOR SILVER BRAZING PREFORM USERS



NEW "CLOSE CLUSTER" DIE PROCESS CUTS BRAZING PREFORM WASTE, SAVES YOU MONEY!

Scrap means waste. And that adds to the cost of your silver brazing preforms. Precision dies arranged in a "close cluster" make maximum use of every inch of silver brazing or precious metal strip. This cuts waste, saves you money. Developed originally by Alloys Unlimited for the semiconductor industry, this new technique of close cluster stamping makes other methods old fashioned. Start saving. Send us your specifications, then compare our bids with your present costs. No obligation, of course.

Alloys Unlimited, Inc., 21-01 43rd Ave., Long Island City 1, N.Y.



Use postpaid card, Circle No. 275



samples? sure!

SEE FOR YOURSELF HOW

GRIES TINY PARTS

DIE CAST ZINC ALLOY and MOLDED ENGINEERING THERMOPLASTICS

... combine high quality, uniformity, accuracy ... at low cost.

GRIES's exclusive high-speed, automated single cavity techniques give you higher quality, more uniformity, offer important production and assembly shortcuts with precision small parts in die cast zinc alloy and molded plastics.

These FREE SAMPLES and detailed bulletins on GRIES's unique services will show you why you can do more ... save more ... when you know more about GRIES. Write for yours TODAY—on company letterhead.

GRIES REPRODUCER CORP.

World's Foremost Producer of Small Die Castings

15 Second St., New Rochelle, N. Y.

New Rochelle 3-8600

Use postpaid card, Circle No. 276

NO SIZE TOO SMALL!
MAXIMUM SIZES:
Zinc Alloy—2", ½ oz.
Nylon, Delrin & other
engineering thermo-
plastics—1¾", .05 oz.



industrial relations. He had been the company's personnel manager since 1955.

Succeeding Gartling is John Kirk. He has been with the company since 1941, with time out for military service.

Paul Bane is now manager of quality control. He joined the company in 1951 and prior to his present appointment he was chief inspector of the quality control department.

Paul Shuttleworth becomes control supervisor. He had been quality control foreman since 1959.

O. Diston Lambirth has been named to the newly created post of manager of engineering. Formerly with Westinghouse Electric, he joined SPS in 1959 as a project engineer, and was promoted to chief engineer in January of this year.

PURCELL PROMOTED BY ROSÁN

Andrew W. Furcell has been promoted to the post of western division sales manager for Rosán, Inc., Newport Beach, Calif.

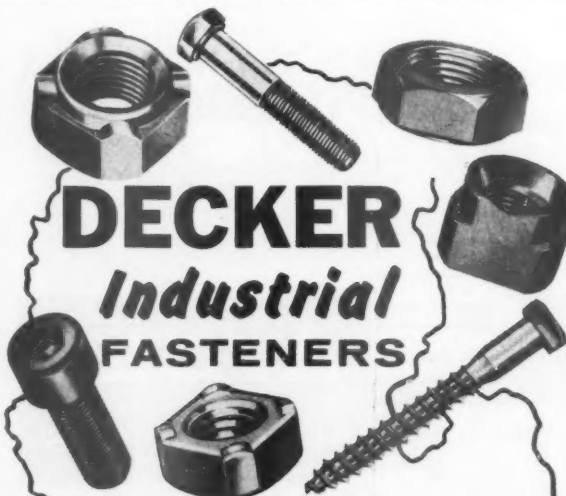
He was formerly project engineer in charge of special projects. Prior to joining Rosán, Purcell had been a standards engineer at Hughes Aircraft Corp. and North American Aviation Corp. plants located in California.



PYLES INDUSTRIES OPENS EASTERN BRANCH

Pyles Industries, Inc., manufacturer of automatic pumping, metering, mixing, and dispensing equipment for use with multi-part sealers, coatings, adhesives, paints, epoxys and catalyzed materials, announced the opening of their eastern branch offices, at 512 Highway 27, Iselin, New Jersey.

The branch will be managed by David R. Davis, formerly Eastern Regional Manager, and will serve all of New England, Eastern New York State, Eastern Pennsylvania, New Jersey, Delaware, Maryland and Virginia.



Decker Industrial Fasteners are manufactured to meet your demands for a better, more positive method of parts assembly. All Decker Fasteners, standard—or special—are produced via the cold-head process to assure a uniform quality with exceptional economy.

Study your production applications now and see for yourself how many ways Decker Fasteners can save your assembly time and dollars. Decker is ready to serve you—any quantity, type or size.

Write today ... for sample fasteners as well as your copy of Decker's complete new catalog.

DECKER NUT MANUFACTURING CORPORATION

1900 N. Clark Road, Albion, Michigan



Use postpaid card, Circle No. 277

Assembly & Fastener Engineering

NAMED REP. FOR J. L. THOMSON

Valley Forge Associates of Devon, Pa., have been named sales representatives for the Judson L. Thomson Mfg. Co. manufacturers of rivets, rivet setting machines, electrical contacts and contact assembly machines.

Headed by James H. LaMent, Charles E. Bradley and Harry K. Tucker, the organization will be responsible for sales in Delaware, Maryland, Northern Virginia and the District of Columbia.

H. M. HARPER INSTALLS COMPUTER CONTROL

H. M. Harper Co., Morton Grove, Ill. has installed electronic equipment capable of controlling the comp ex manufacturing operations of its fasteners and metals divisions.

The equipment, an IBM 305 Ramac, will coordinate all major functions of the company including inventory control, machine load and scheduling, sales forecasting, raw material, finished goods and order filling.

CONTRACT ENGR. DIRECTOR AT STD. TOOL

Z. E. Zilaly has been named director of the contract engineering division of Standard Tool & Manufacturing Co. In his new post Zilaly will be responsible for the special customer projects and customer product development programs which are handled by this division.

CLECO PROMOTES THREE

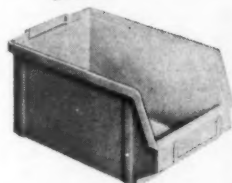
Cleco Air Tools division of Reed Roller Bit Co., has announced these recent changes in its sales organization.

E. W. Clayton, formerly sales manager of the Cleco division, has been named director of marketing and sales.

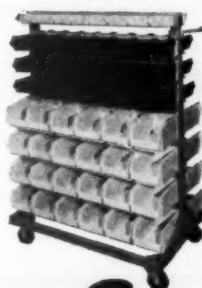
E. G. Clark, formerly regional manager for the Newark, Detroit, Philadelphia, Pittsburgh, Cleveland and Chicago divisions has been promoted to domestic sales manager.

Lewis UNITIZED ASSEMBLY CONTAINERS

FOR
• ASSEMBLY
• PRODUCTION
• STORAGE



Lewis Plastibox containers are one-piece molded plastic. They are smooth, strong, non-corrosive, easily cleaned. Colors, either green or yellow, are molded-in. Plastibox containers stack securely and afford maximum storage of small parts. Sizes available are 8 1/2" long x 5" wide x 4 1/2" deep, 6" x 3 1/2" x 2 1/2", 3" x 3 1/2" x 1 3/4", and 3" x 3 1/2" x 1 3/4" with a vertical divider.



MOUNTING RAILS— Rails are supplied in 18" and 36" lengths to mount 4 or 8 of the 3 smaller size Plastibox containers; 3 or 6 of the largest size. Rails afford a wide variety of bench or wall arrangements for any assembly or storage operation.

MOBILE TRUCK ASSEMBLY— These Lewis trucks handle all sizes of Plastibox containers and allow the boxes to be quickly and easily moved from one area to another. Trucks furnished with 36" mounting rails, two swivel and two rigid casters, and are finished in grey enamel.

WRITE TODAY
for complete information
and brochure

G.B. **Lewis** COMPANY

2011 Montgomery Street • Watertown, Wisconsin
Use postpaid card. Circle No. 279

HOLD EVERYTHING!

with ANCHOR Fasteners

Specialists in manufacturing fasteners of all kinds and sizes in any type of material.

Specify ANCHOR stock or special fasteners for SPEED, RELIABILITY, ECONOMY and SERVICE. ANCHOR has the answer to all of your assembly problems.

Manufacturers
of Standards
and Specials in:

- CAP SCREWS
- WELD SCREWS
- SLOTTED & PHILLIPS MACHINE SCREWS
- SHEET METAL SCREWS
- THREAD CUTTING SCREWS
- PLASTIC SCREWS
- SET SCREWS
- WOOD SCREWS
- NUTS (Metal & Plastic)
- LAG BOLTS
- MACHINE BOLTS
- CARRIAGE BOLTS
- RIVETS
- LOCK PINS
- WASHERS
- SCREW MACHINE PRODUCTS

Write today for more information and prices.

ANCHOR BOLT & SCREW CO.

2952 W. Grand Avenue • Chicago 22, Illinois
Phone: AL 2-2200

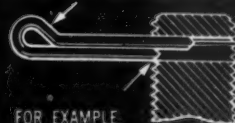
EVERY KIND, SHAPE, SIZE COTTER PIN

for any specific purpose
or general mechanical
use is manufactured by



Western Wire makes the largest and most complete line of cotter pins in the U.S. WW Cotter Pins are consistently accurate even in complicated shapes — designed and produced in strict accordance to specifications.

Write for prices and samples too, if wanted.



FOR EXAMPLE
Castle Cotter
COTTER PINS

Expressly made for
castellated, grooved
and special nuts.

NO HAMMER DAMAGE TO
VALUABLE FITTINGS

Fig. 1—Offset head counter-sinks with no forcing.

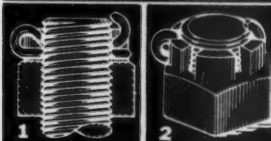


Fig. 2—Long prong is designed to clinch back to maximum "safe" position; holds nut securely.

SIZES AVAILABLE TO MEET
ANY REQUIREMENTS FOR
INDUSTRIAL AUTOMOTIVE AND
AIRCRAFT USE. AVAILABLE
IN A-N 380 & 381 SPECS.

For Stud Setting and Pulling and TORQUE CONTROL TOOLS

"Tittentorker" Controlled Torque Driver



For variety of torque uses. Audible signal when desired torque is reached. Easy adjustment. Four sizes: maximum torques from 75" lb. to 225" lb. Female adapters in driving head; male adapters on torque base.

Heavy Duty Jaw Controlled (Torque) Drive Stud Driver



New heavy duty jaw brings the ultimate within reach for users of self-opening stud drivers. Predetermined amount of torque can be applied to stud during driving. For use with any air or electric drill or drill press. Sizes No. 101—No. 102—No. 103.

"Bull Dog" Stud Driver



Designed for Use With Impact Wrenches

Built for rugged use on heavy engines. Equipped with Titan Design, Loose Pressure Plunger. Definitely stands up under vibration encountered when using an impact wrench for motive power.

Titan "Roll Grip"



Combination Stud Driver and Puller

Incorporates roll action to grip as little as 1/8 in. of unthreaded body of stud. Made in standard sizes from 3/16 to 3 in. inclusive.

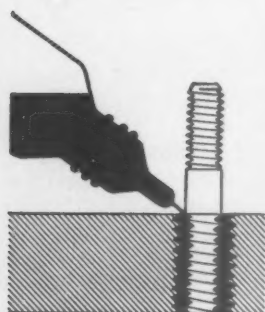


World's Largest Producers Of
Stud Drivers, And Pullers

TITAN TOOL CO.

47 MAIN ST., FAIRVIEW (ERIE COUNTY), PA.

Use postpaid card. Circle No. 231



**Eliminate
loose studs
with
Loctite
Sealant**

A "nut and bolt" type fit is all that is required when Loctite Sealant is used to hold studs in place. Loctite's locking action, developing after stud is in place, eliminates need for interference fits... and breakage due to high driving torques. No blind hole tapping—drill clean through... Loctite seals and locks in one operation.

Call your distributor, or write us for literature and free sample.

LOCTITE[®] SEALANT

AMERICAN SEALANTS COMPANY

135 NORTH MOUNTAIN ROAD • HARTFORD 11, CONN.

Use postpaid card. Circle No. 232

He had previously served as regional manager for the Houston, Atlanta, St. Louis and Los Angeles divisions.

All three will make their headquarters in Houston.

SALES ENGINEER FOR PARKER-KALON

Robert E. Sheehan has been appointed field sales engineer for the Parker-Kalon division of General American Transportation Corp.

He will serve as fastener consultant contacting distributors and their customers in the Los Angeles and southern California area.

PURCHASING AGENT FOR ANTI-CORROSIVE

Lawrence Ennis has been named purchasing agent for Anti-Corrosive Metal Products Co. He succeeds Frank Legnard, who was recently promoted to general manager of the company.

Formerly assistant purchasing agent, Ennis has been with the company for more than ten years

VICE-PRESIDENT-SALES FOR HASSALL, INC.

Edward F. Karnes has been elected vice president-sales for John Hassall, Inc. Karnes has been associated with the company for over thirty years. His previous position was sales manager, devoting much of his time to application engineering for the firms line of special cold headed parts and fasteners.

SKIL NAMES SERVICE MANAGER

L. L. (Sandy) Stuart has been appointed service operations manager of Skil Corporation.

He has been associated with the company since 1950, was customer service manager prior to assuming his new position. As service operations manager, he will be in charge of all the company's factory service centers in the United States.

MULTIPLE SPINDLE SCREWDRIVING MACHINES

A complete line of equipment for high production. Feed and drive screws in Multiples up to 10 screws at a time.

SINGLE SPINDLE SCREWDRIVING MACHINES

For assemblies that require the driving of one screw at a time.

NUT SETTING MACHINES

Mechanize Nut driving operations.

INSERTING EQUIPMENT

Feed and insert pins, rivets, etc. singly or in multiples.

PART FEEDERS

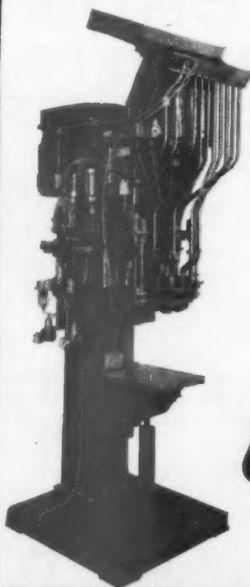
A complete line of feeding equipment. Various types and sizes to suit job requirements.

COMPONENTS

All above machines can be furnished adapted for incorporation into Automatic Assembly Machinery.

ASSEMBLY EQUIPMENT

Economical machines designed and built around standard Cook & Chick components to meet job requirements.



COOK & CHICK COMPANY

2415 West 25th Street Chicago 8, Illinois

Use postpaid card. Circle No. 233

Assembly & Fastener Engineering

UNITED SHOE NAMES FASTENER ENGINEER



Edward E. Tschantz has been appointed to the newly created position of chief engineer of the Fastener Division, United Shoe Machinery Corporation. He will be located in United's Shelton, Conn., plant, where activities of the division are centered. He will be responsible for engineering and product development of United eyelets, "POP" rivets and "POP" rivet setting tools. The development of

United's eyeleting machines will remain the responsibility the company's main plant in Beverly, Mass.

Tschantz brings to his new position more than 12 years of experience as a consultant tool engineer for Lockheed Aircraft Company, Burbank, California, and more than nine years combined as a tool engineer for one blind rivet manufacturer and as chief engineer for a second—both located in the heavily military-oriented market area of southern California.

ELECTED V-P AT RAYTHEON

Kenneth M. Lord has been elected vice president-manufacturing and purchasing for Raytheon Company.

He has resigned as vice president and general manager of the Military Products Division, General Dynamics Electronics to take the newly-created Raytheon post.

ASME NOMINATES OFFICERS

Clifford H. Shumaker, chairman of the Department of Industrial Engineering of Southern Methodist University, has been named to serve as president of the American Society of Mechanical Engineers.

Professor Shumaker, together with six vice presidents and three directors, also nominated will begin his term in June of 1962, following a mail ballot of the membership this fall.

Named to serve two year terms as vice presidents were:



DON'T DISPOSE OF DOODLES if they pertain to fastening problems

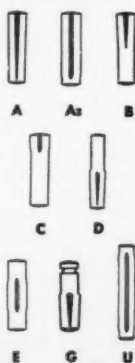
Next time you're sketching out a problem, give Driv-Lok a crack at it. We can pin down quite a bit of helpful information from a doodle.

We'd like to know what the application is, dimensions, metals used, and any pertinent factors such as shock or vibration, corrosion, electrical properties... the things needed to let us give you a proper pin recommendation and a price.

Driv-Lok's wide variety of grooved pins and agile engineering ability have solved a multitude of fastening problems. We'd like a chance at yours.



■ STANDARD TYPES PLUS SPECIALS in a variety of metals. Send for your free catalog and samples, too.



DRIV-LOK SALES CORPORATION

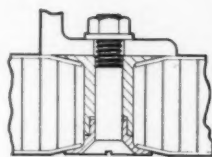
731 PARK AVENUE • SYCAMORE 4, ILLINOIS
Use postpaid card. Circle No. 284

November, 1961

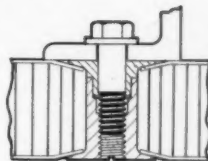
HONEYCOMB and sandwich panel FASTENERS

PATENT PENDING

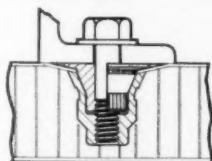
by *Delron*



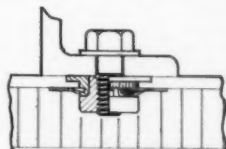
GROMMET FASTENER
Series 101 and 102
Thru-Rivet and Thru-Bolt Type



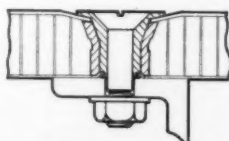
GROMMET FASTENER
Series 103
Series 104 (Self-Locking)



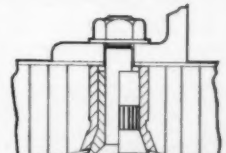
BLIND FASTENER
Series 293
Internal Thread Blind Type



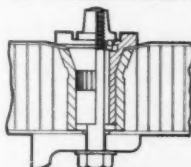
BLIND FASTENER
Series 293K
Threaded Clinch Type



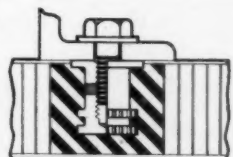
STRUCTURAL FASTENER
Series 600 Flared
Thru-Rivet and Thru-Bolt Type



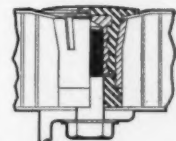
STRUCTURAL FASTENER
Series 600 Regular
Thru-Rivet and Thru-Bolt Type



STRUCTURAL FASTENER
Series 700
Floating Locknut Type



MOLDED-IN INSERT
Series 404H
Blind Molded-In Type



STRUCTURAL PLASTIC FASTENER
Series 680
Internal Thread Type

Illustrated are only a few of the many available types of Delron Sandwich Panel Fasteners. Write for complete Technical Data.



THE DELRON COMPANY, INC.

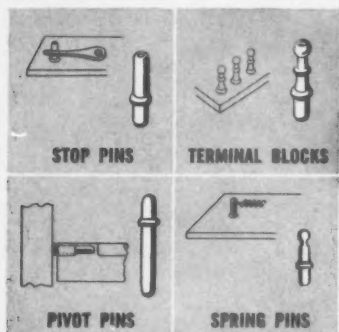
5224 Southern Ave., South Gate, Calif. • LOrain 7-2477

Largest Manufacturer of Specialized Sandwich Panel Fasteners.

Use postpaid card. Circle No. 285

BIG SAVINGS

ON TINY TUBULAR PARTS



**BEAD CHAIN
MULTI-SWAGE
PARTS**

**For
Economical,
Dependable,
High-Volume
Production!**

The advanced manufacturing method, developed and used exclusively by Bead Chain, swages practically any type of small tubular part from flat stock into precision forms with positive, tight seams. Diameters up to $\frac{1}{4}$ ", lengths to $1\frac{1}{2}$ ".

If you can use high-volume production, we can deliver it at a much faster rate and at far less cost!



Send us a blueprint or sample and quantity requirements. We will quickly show you the big economies we can deliver.



THE BEAD CHAIN MANUFACTURING COMPANY
208 Mountain Grove St., Bridgeport 5, Conn.

Use postpaid card. Circle No. 236

Now! An AIR HOSE

THAT STRETCHES AND RECOILS JUST
LIKE A TELEPHONE CORD!



Pat. Pending

**EASIER AND SAFER TO USE
INCREASES EFFICIENCY
RESISTANT TO ABRASION**

NYCOIL—the original recoiling air hose stretches from a compact 9 inches to 20 feet and beyond! Because it is always out of the way, there is less chance of damage to work or worker. Its bright, red color and self-storing ability offer a high safety factor.

NYCOIL fittings allow full flow of air and are easy to connect to any tool or equipment requiring air pressure up to 200 psi. No expensive recoil mechanisms required. If you are now using air—you certainly need NYCOIL.

SEND NOW FOR DESCRIPTIVE FOLDER AND PRICES

nycoil
NYCOIL RECOILING AIR HOSE

NYCOIL COMPANY—Westfield 2, New Jersey

Use postpaid card. Circle No. 237

ASME Region 1—Edward H. Walton, vice president-engineering, The United Illuminating Co., New Haven, Conn.

ASME Region III—Robert W. Worley, chief power engineer, United Engineering and Construction Co., Philadelphia, Pa.

ASME Region V—Robert Nelson, manager—product support publications, General Electric Co., Cincinnati, Ohio.

ASME Region VII—Niles H. Bernard, professor and chairman, Department of Mechanical Engineering, University of Nebraska, Lincoln, Neb.

ASME Region IX—Emmett E. Day, professor of Mechanical Engineering, University of Washington, Seattle, Wash.

ASME Region XI—Thomas J. Judge, coordinator of power plants, International Paper Co., Mobile, Ala.

Three directors, named to serve four years are:

Ernst W. Allardt, chief engineer, Tubular Prod. Div., The Babcock and Wilcox Co., Alliance, Ohio.

George M. Muschamp, vice president-engineering, Minneapolis Honeywell Regulator Co., Brown Instrument Div., Philadelphia, Pa.

John Parmakian, chief, Technical Engineering Analysis Section, U.S. Bureau of Reclamation, Denver, Colo.

DISTRIBUTORS FOR G.E. RTV SILICONES

Accompanying their announcement of marketing RTV, room temperature vulcanizing, liquid silicone rubber compounds in one pound packages, General Electric has named five new regional distributors for the silicone line.

The new distributors are: Electrical Specialty Co., San Francisco; Federal Insulation Co., Chicago; Insulation and Copper Sales, Detroit; Smooth-On Manufacturing Co., Jersey City and Punt Inc., Floral Park, N.Y.

ANTI-CORROSIVE INDIANA SALES OFFICE

Establishment of an Indianapolis, Indiana, office to service the entire state of Indiana was announced by Anti-Corrosive Metal Products Co., Inc.

The company also announced the appointment of Robert

NEW DIXON AUTO-TORQUE Driver

**SCREWS AND NUTS AUTOMATICALLY DRIVEN
WITH PRECISE TORQUE CONTROL**

Gives you . . .

- 1 Complete control of screws from parts feeder to chuck, until threads are started. No dependence on gravity to load chuck.
- 2 Exclusive built-in sensing, assures that screw is driven. Automatically retracts driver only after obtaining proper torque.
- 3 Complete automatic cycle, requires only a touch of the pedal.
- 4 Torque accuracy within 5%, comparable to most precise hand-torquing methods.
- 5 Clutch free-wheels after driving. Operator cannot vary the torque.
- 6 Two ranges of torque available 0 to 84 inch-pounds and 48 to 120.
- 7 Work height adjustment with 14" range, can be made without in any way disturbing the machine adjustments.

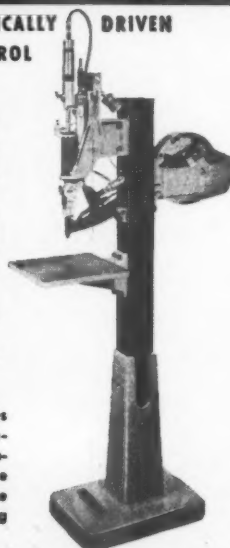
The new DIXON Auto-Torque Driver includes all the features of the DIXON Auto-Positioner, and has an efficient space-saving air motor with an adjustable-torque clutch. These features provide for positive handling, giving new efficiency in driving screws and nuts.

Full information available in Bulletin No. SD-81.

DIXON AUTOMATIC TOOL, INC.
2309 - 23rd AVENUE
ROCKFORD, ILLINOIS



EQUIPMENT FOR AUTOMATIC PARTS HANDLING AND ASSEMBLY



Model SD-100, above, tooling for any standard screw up to $\frac{1}{2}$ " thread size. Special tooling units with multiple feeders available. Model SD-101, without floor column, provides a complete automatic station. Maximum width 6 inches.

Use postpaid card. Circle No. 238

Assembly & Fastener Engineering

Lay as manager of the Indiana operation. Lay has a background of nine years of sales experience in the fastener industry.

Anti-Corrosive is a manufacturer of stainless steel and nylon fasteners.

SWANSON-ERIE NAMES REPRESENTATIVE



Central States Machinery Company, Inc., Indianapolis has been named exclusive representatives of The Swanson-Erie Corp.

A staff of industrial sales engineers headed by Robert D. Bussell, general manager of Central States Machinery, will handle all Swanson-Erie product sales and application activities throughout Indiana and in northern counties of Kentucky including the Louisville and Lexington areas.

Swanson-Erie manufactures a complete line of automatic assembly and processing equipment, including turret indexing machine chassis and completely engineered special machines.

AMERICAN SEALANTS WEST COAST S.M.

George F. Heath of Los Angeles has been appointed district sales manager by the American Sealants Co. Based in Los Angeles, he will work with the company's representatives and distributors to co-ordinate sales of the company's sealing and locking compound throughout the eleven-state western area.

APPOINTED V.P. AT GREAT LAKES

M. H. Zelibor has been named vice-president-manufacturing of Great Lakes Screw Corporation. Zelibor was formerly plant manager.

molded
Black Nylon
screws
and nuts

Insulate and Fasten
without bushings,
washers, etc. In Stock
2-56, 4-40, 6-32, 8-32,
10-32 and 1/4-20.



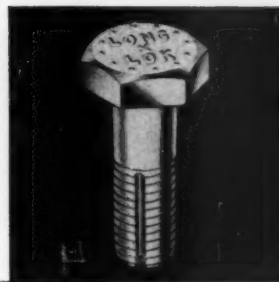
Black Nylon
"NyGrip"
cable
clips

Light-weight non-
conducting support
for wiring, tubing, etc.
In Stock 1/8" to
1 1/2" Dia.

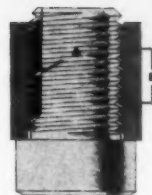
Free samples • write **WECKESSER CO.**

5701-A Northwest Hwy. • Chicago 46, Ill.

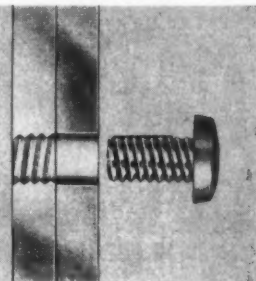
This is a **LONG-LOK Self-Locking Screw**. It is a one-piece reusable fastener, heat, vibration, impact and shock resistant.



It is vibration resistant because the resilient, reformable insert (A) acts as a wedge between the male and female threads, causing a metal-to-metal drag (B).



LONG-LOK Self-Locking Screws are flush protruded and pass through normal clearance holes with finger pressure. No special clearance holes are required.



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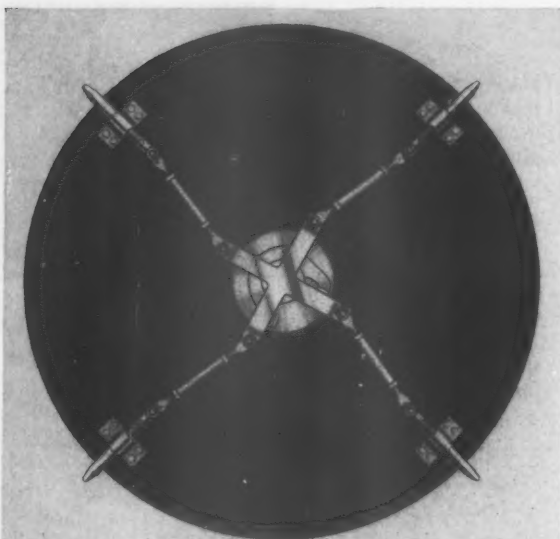
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TO MANAGE WALDES-KOHINOOR WESTERN DIV.

James A. D'Errico has been named western division manager for the Truarc Retaining Ring Division of Waldes Kohinoor. He succeeds Mel S. Nielsen, who has resigned.

D'Errico joined Waldes last May as western manager of the company's Aircraft Products Division and will continue to serve in that capacity. In his new position he will be responsible for West Coast sales of retaining rings, assembly tools and the stressed panel fastener.



ROTOR TOOL NAMES PHILADELPHIA REP.

William Beatty has been named sales engineer for Rotor Tool Co., Cleveland, Ohio. He will sell and service the company's complete line of air and high cycle portable tools.

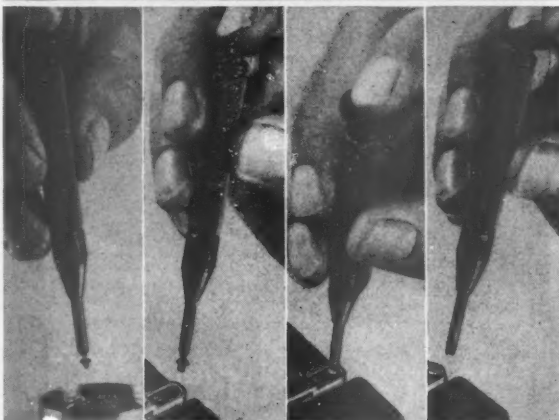
Beatty has been handling air tool equipment through the B&B Supply Co. for the past four years. Prior to organizing his own company, he was assistant district manager for another air tool manufacturing firm.



REINHARDT NAMED SOCIETY HEAD

John W. Reinhardt, production manager of Parker Fittings & Hose Division, Parker-Hannifin Corp., Cleveland, has been elected president of the Cleveland chapter of the American Production and Inventory Control Society. With this election he becomes a trustee of the national organization. This society, originally formed in Cleveland, now has 52 chapters with national headquarters in Chicago, where a technical conference and exhibit will be held in September.

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GENERAL S.M. AT CHICAGO PNEUMATIC



The Chicago Pneumatic Tool Co. has named Russell B. Miller general sales manager of the company. His headquarters will be in the New York general offices.

In his new capacity, Miller will be responsible for coordinating the sales of all the company's products, including air and electric tools, compressors, diesel and gas engines and rock drilling equipment.

H.M. FRANCIS OF AM. STEEL RETIRES



Harry M. Francis, vice president of the American Steel and Wire division of U. S. Steel Corp. retired on July 31. He was with the division for 46 years.

Joining the company in 1915 as a messenger, he rose through the sales ranks, to become vice president-sales, in 1946. In March, 1959 he was named executive vice president.

Francis is a navy veteran of the first World War, and he served on the War Production Board for 3½ years in World War II.

A. C. DANEKIND OF MAYTAG RETIRES

A. C. Danekind, assistant to the president of the Maytag Company since joining the laundry appliance firm in June, 1948, retired on Aug. 31.

Danekind who became a company officer in 1949, came to Maytag from General Electric Company, Schenectady, N.Y., where he served in various staff positions. While at Maytag, he has been assigned many special projects relating to the company's expansion program.

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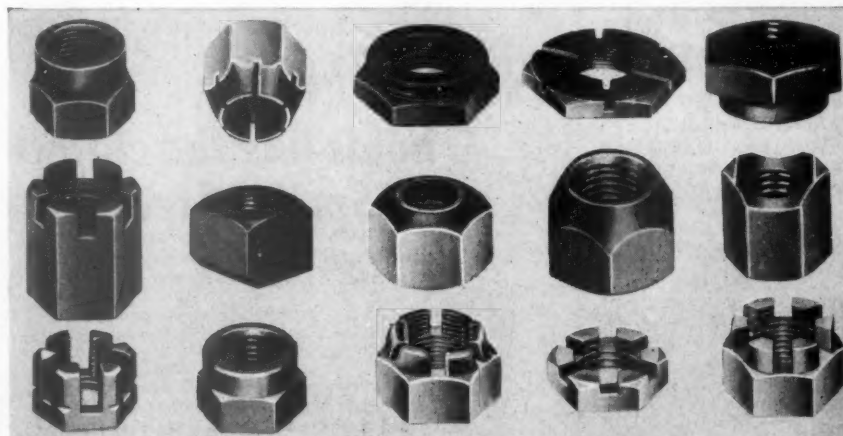
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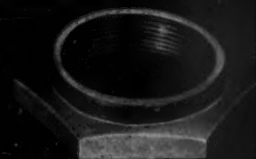


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- 38—Planning Assembly Work Stations**
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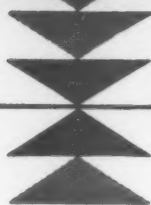


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ONE LAST WORD

IT'S ONLY A MATTER OF PROPER PRUNING



We must reduce expenditures for supplies and materials! Can't we cut costs on these electrode supplies? Let's put someone on this and cut down on the purchases? What are the guys in Department 15 doing, eating those fasteners for lunch?

And so it goes. Whether it concerns welding electrodes or other perishable tools, fastener supplies, or a series of assembly operations, you know the record well. The rest is also known: a committee is formed to "look into things" with a view toward reducing costs.

Now the majority of you will certainly agree that efforts to reduce costs are important; no one slights this worthy endeavor. Costs are like privet hedges; they must be kept pruned or they will grow completely berserk. But, like a privet hedge, one shouldn't trim them just for the fun of it without plan or program, and just snip around with dull pruning shears because it gives one a feeling of noble accomplishment.

There is nothing noble about a hedge looking like a skinned cat which will wither and die because it's been under the clippers and tortured to death. There is nothing worthy about a cost-cutting program which bores the heart out of efficiency and production. The dividing line between intelligent cost reduction analysis and haphazard slashing is so very fine, but the results can be so devastating.

Money can be saved if the final measure of success is lower assem-

bly costs without a loss of production or a compromise of quality. On the other hand, costs can be slashed by spending money for the acceleration of a line which will result in an upsurge in output.

There are two classic illustrations. If you merely want to save money, pull the master electric switch and you'll get no electric bill next month. Think of the savings! Or you can install new lighting in the assembly department so those poor souls won't have to peer at their work through candlelight. It's all very silly, isn't it?

And yet, how many men are zealously dashing about, on the order of a vague inter-office memo, slashing and hacking and mutilating indiscriminately—just for the sake of pennies. The economic law of business life is stern about this sort of thing!

Each operation should be approached as though it were a hungry gorilla—softly and with guarded caution. Cost-cutting must not be based on saving pennies which are to be wasted later for the repair of the damage. Cost-cutting should be rooted in one basic thought: how much more production will accrue as a result of careful analysis? An analysis which may bring about savings in time, labor or even perishable supplies.

So, if we're trimming the privet hedge, fellows, get a power shears instead of the hand clippers, and save yourself a lot of time, while doing a better job.

Wm. F. Schleicher

VICE PRESIDENT

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